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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

PUBLISHED WITH THE CO-OPERATION OF THE SMITHSONIAN INSTITUTION.

VOLUME III.

JULY 1, 1884, TO FEBRUARY 6, 1886.

WASHINGTON:
PRINTED FOR THE SOCIETY.
1886.

GIBSON BROS.
PRINTERS AND BOOKBINDERS,
WASHINGTON, D. C.

PUBLICATION COMMITTEE.

RICHARD RATHBUN. WILLIAM H. DALL,
ROMYN HITCHCOCK. C. HART MERRIAM.
FREDERIC A. LUCAS.

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LIST

OF THE

OFFICERS AND COUNCIL

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

ELECTED JANUARY 10, 1885.

OFFICERS.

PRESIDENT.

G. BROWN GOODE.

VICE-PRESIDENTS.

CHARLES V. RILEY, WILLIAM H. DALL,
LESTER F. WARD, OTIS T. MASON.

SECRETARIES.

RICHARD RATHBUN, FRANK BAKER.

TREASURER.

FREDERICK W. TRUE.

COUNCIL.

G. BROWN GOODE, *President.*

FRANK BAKER, CHARLES V. RILEY,
WILLIAM H. DALL, FREDERICK W. TRUE,
THEODORE GILL,* GEORGE VASEY,
ROMYN HITCHCOCK, CHARLES D. WALCOTT,
JEROME H. KIDDER, LESTER F. WARD,
OTIS T. MASON, JACOB L. WORTMAN,
RICHARD RATHBUN, CHARLES A. WHITE.*

* Ex-Presidents of the Society.

STANDING COMMITTEES

1885.

COMMITTEE ON COMMUNICATIONS.

FREDERICK W. TRUE, *Chairman.*

FRANK BAKER, RICHARD RATHBUN.

COMMITTEE ON PUBLICATIONS.

RICHARD RATHBUN, *Chairman.*

CHARLES V. RILEY, ROMYN HITCHCOCK,

WILLIAM H. DALL, WILLIAM H. SEAMAN.

HENRY G. BEYER.

COMMITTEE ON LECTURES.

OTIS T. MASON, *Chairman.*

FREDERICK W. TRUE, WILLIAM BIRNEY,

THEODORE GILL. JEROME H. KIDDER.

COMMITTEE ON THE TREES AND SHRUBS OF WASHINGTON.

LESTER F. WARD, *Chairman.*

WILLIAM SMITH, GEORGE VASEY,

FRANKLIN B. HOUGH.

LIST

OF THE

OFFICERS AND COUNCIL

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

ELECTED JANUARY 23, 1886.

OFFICERS.

PRESIDENT.

G. BROWN GOODE.

VICE-PRESIDENTS.

WILLIAM H. DALL, LESTER F. WARD,
CHARLES V. RILEY, FRANK BAKER.

SECRETARIES.

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TREASURER.

FREDERICK W. TRUE.

COUNCIL.

G. BROWN GOODE, *President.*

FRANK BAKER, RICHARD RATHBUN,
TARLETON H. BEAN, CHARLES V. RILEY,
WILLIAM H. DALL, FREDERICK W. TRUE,
THEODORE GILL,* GEORGE VASEY,
ROMYN HITCHCOCK, CHARLES D. WALCOTT,
OTIS T. MASON, LESTER F. WARD,
C. HART MERRIAM, CHARLES A. WHITE.*

* Ex-Presidents of the Society.

STANDING COMMITTEES

1886.

COMMITTEE ON COMMUNICATIONS.

FREDERICK W. TRUE, *Chairman.*

C. HART MERRIAM. ROMYN HITCHCOCK.

COMMITTEE ON PUBLICATIONS.

RICHARD RATHBUN, *Chairman.*

WILLIAM H. DALL, C. HART MERRIAM,

ROMYN HITCHCOCK, FREDERIC A. LUCAS,

COMMITTEE ON LECTURES.

OTIS T. MASON, *Chairman.*

CHARLES V. RILEY, CHARLES D. WALCOTT,

FREDERICK W. TRUE, FRANK BAKER.

COMMITTEE ON THE TREES AND SHRUBS OF WASHINGTON.

LESTER F. WARD, *Chairman.*

WILLIAM SMITH, FRANK H. KNOWLTON,

GEORGE VASEY, F. LAMSON SCRIBNER.

LIST OF MEMBERS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

JANUARY 23, 1886.

HONORARY MEMBER.

	Date of Election.
BAIRD, SPENCER FULLERTON, M. D., LL. D., M. N. A. S., Secretary of the Smithsonian Institution and Director of the U. S. National Museum; U. S. Commissioner of Fish and Fisheries; Foreign Member of the Zoological and Linnean Societies of London. *Smithsonian Institution, and 1445 Massachusetts Avenue N. W.*	1881, Jan. 14.

CORRESPONDING MEMBERS.

AGASSIZ, ALEXANDER, A. B., S. B., M. N. A. S., Curator of the Museum of Comparative Zoology, Cambridge; Foreign Member of the Zoological and Linnean Societies of London. *Cambridge, Massachusetts.*	1882, Mar. 31.
AGUILERA, JOSÉ G., Naturalista de la Comision Geografico Exploradora. *City of Puebla, Mexico.*	1886, Jan. 9.
ALLEN, HARRISON, M. D. *117 South Twentieth Street, Philadelphia, Pennsylvania.*	1882, Dec. 22.
ALLEN, JOEL ASAPH, M. N. A. S., C. M. Z. S., Curator of Ornithology and Mammalogy, American Museum of Natural History; President of the American Ornithologists' Union; Editor of "The Auk." *New York City.*	1882, April 8.
BARCENA, MARIANO, Profesor de Geologia en la Escuela Preparatoria. *City of Mexico, Mexico.*	1886, Jan. 9.
BREWER, WILLIAM HENRY, Ph. D., M. N. A. S., Professor of Agriculture in the Sheffield Scientific School, Yale College, New Haven. *New Haven, Connecticut.*	1882, April 28.

CORRESPONDING MEMBERS—Continued.

	Date of Election.
BREWSTER, WILLIAM, Assistant in the Museum of Comparative Zoology, Cambridge. *61 Sparks Street, Cambridge, Massachusetts.*	1881, Feb. 25.
BROOKS. WILLIAM KEITH, Ph. D., Associate Professor of Biology and Director of the Marine Laboratory of Johns Hopkins University, Baltimore. *Baltimore, Maryland.*	1881, Feb. 25.
COLLETT, ROBERT, C. M. Z. S., Conservator of the Zoological Museum of the University of Christiania. *Christiania, Norway.*	1882, Jan. 6.
COPE, EDWARD DRINKER, M. A., M. N. A. S., C. M. Z. S., Editor of "The American Naturalist." *2100 Pine Street, Philadelphia. Pennsylvania.*	1882, Dec. 22.
DERBY, ORVILLE ADELBERT, M. S., Curator of the Geological Section of the National Museum of Brazil. *Rio de Janeiro, Brazil.*	1881, April 14.
DOBSON, GEORGE EDWARD, M. A., M. B., F. R. S., F. Z. S., Surgeon Major R. N. *Exeter, Devonshire, England.*	1884, Nov. 15.
FARLOW, WILLIAM GILSON, A. M., M. D., M. N. A. S., Professor of Cryptogamic Botany in Harvard University. *Cambridge, Massachusetts.*	1882, Jan. 6.
FLOWER, WILLIAM HENRY, LL. D., F. R. S., Pres. Z. S., F. L. S.; Director of the Natural History Departments of the British Museum. *South Kensington, London, S. W., England.*	1884, Feb. 8.
GIGLIOLI, ENRICO HILLYER, D. Sc., C. M. Z. S., Director of the Royal Zoological Museum of Vertebrates, and Professor of Vertebrate Zoology in the Royal Institute, Florence. *R. Istituto di Studi Superiori, Florence, Italy.*	1881, Mar. 11.
GRAY, ASA, M. D., LL. D., M. N. A. S., Fisher Professor of Natural History in Harvard University; Foreign Member of the Royal Society of London, and of the Institute of France. *Botanic Garden, Cambridge, Massachusetts.*	1882, Jan. 6.
HORN, GEORGE HENRY, M. D., Pres. American Entomological Society. *874 North Fourth Street, Philadelphia, Pennsylvania.*	1884, Feb. 8.

CORRESPONDING MEMBERS—Continued.	Date of Election.
HUBRECHT, A. A. W., C. M. Z. S., &c., Professor of Natural History in the University of Utrecht. *Utrecht, Holland.*	1884, Jan. 11.
HYATT, ALPHEUS, S. B., M. N. A. S., Professor of Zoology and Palæontology in the Massachusetts Institute of Technology; Custodian of the Boston Society of Natural History; President of the Society of Naturalists of the Eastern United States. *Cambridge, Massachusetts.*	1882, Jan. 6.
JORDAN, DAVID STARR, M. S., M. D., Ph. D., President of the Indiana University. *Bloomington, Indiana.*	1883, Jan. 5.
LAWRENCE, GEORGE N., C. M. Z. S. *45 East 21st St., New York City.*	1881, April 8.
LEIDY, JOSEPH, M. D., LL. D., M. N. A. S., F. M. Z. S. L.; Professor of Anatomy in the University of Pennsylvania; President of the Academy of Natural Sciences of Philadelphia. *Philadelphia, Penn.*	1884, Dec. 27.
LYMAN, HON. THEODORE, A. M., M. N. A. S. *Brookline, Mass.*	1883, Dec. 14.
MARK, EDWARD LAURENS, Ph. D., Hersey Professor of Anatomy, Harvard University, and Assistant in the Museum of Comparative Zoology, Cambridge, Mass. *Cambridge, Massachusetts.*	1884, Nov. 15.
MARSH, OTHNIEL CHARLES, M. A., Pres. N. A. S., Professor of Palæontology in Yale College, and Palæontologist to the U. S. Geological Survey. *New Haven, Connecticut.*	1884, Feb. 8.
MARTIN, HENRY NEWELL, A. M., M. D., D. Sc., Professor of Biology in Johns Hopkins University. *Baltimore, Maryland.*	1882, Dec. 22.
MORSE, EDWARD S., Ph. D., M. N. A. S., Director of the Peabody Academy of Science, Salem. *Salem, Mass.*	1882, Mar. 31.
MOSELEY, HENRY NOTTIDGE, A. M., F. R. S., F. L. S., F. Z. S., &c., Linacre Professor of Human and Comparative Anatomy in the University of Oxford. *14 St. Giles, Oxford, England.*	1883, Nov. 30.
PACKARD, ALPHEUS SPRING, Jr., A. M., M. D., M. N. A. S., Professor of Zoology and Geology in Brown University, Providence; Editor of "The American Naturalist." *Providence, Rhode Island.*	1882, Mar. 31.

CORRESPONDING MEMBERS—Continued.	Date of Election.
PEREZ, FERNANDO FERRARI, President of the University of Puebla; Naturalista de la Comision Geografico Exploradora. *City of Puebla, Mexico.*	1886, Jan. 9.
SCLATER, PHILIP LUTLEY, M. A., Ph. D., F. R. S., Secretary of the Zoological Society of London. *3 Hanover Square, London, W., England.*	1884, Nov. 15.
SCUDDER, SAMUEL HUBBARD, A. M., M. N. A. S., President of the Boston Society of Natural History. *Cambridge, Massachusetts.*	1882, Dec. 22.
SMITH, SIDNEY IRVING, Ph. B., Professor of Comparative Anatomy in Yale College, New Haven. *New Haven, Connecticut.*	1882, Mar. 3.
VELIE, JOHN W., M. D., Secretary and Curator of the Chicago Academy of Sciences. *263 Wabash Avenue, Chicago, Illinois.*	1881, Feb. 25.
VERRILL, ADDISON EMORY, A. M., S. B., M. N. A. S., Professor of Zoology, and Curator of the Zoological Collections in Yale College, New Haven. *New Haven, Connecticut.*	1882, Mar. 31.
WATSON, SERENO, Ph. D., M. N. A. S., Curator of the Herbarium of Harvard University. *Botanic Gardens, Cambridge, Massachusetts.*	1882, April 28.
WHITMAN, CHARLES OTIS, M. A., Ph. D., Embryologist, Museum of Comparative Zoology. *Cambridge, Massachusetts.*	1884, Nov. 15.
WILSON, EDMUND BEECHER, Ph. D., Professor of Natural History in Bryn Mawr College. *Bryn Mawr, Pennsylvania.*	1882, Mar. 3.

ACTIVE MEMBERS.*

ACKER, GEORGE N., M. D. *1403 New York Avenue, N. W.*	1883, Jan. 19.
AMES DELANO. *1600 13th Street, N. W.*	1883, Jan. 19.
ASHFORD, FRANCIS ASBURY, M. D. (*Deceased.*)	Orig. Member.
BAKER, FRANK, M. D. *Office of Light-House Board, and 326 C Street, N. W.*	1881, Jan. 14.

* Unless otherwise stated, all addresses are in Washington. By the words "Original Member" are designated those who attended the meetings for organization, November 26 and December 3, 1880.

ACTIVE MEMBERS—Continued.	Date of Election.
BALDWIN, ALBERTUS HUTCHINSON. *Smithsonian Institution.*	1884, Nov. 29.
BARKER, JOHN SHEPARD. *715 H Street, N. W.*	1882, Mar. 3.
BARNARD, WILLIAM STEBBINS. *917 New York Avenue.*	1881, Nov. 11.
BATES, HENRY HOBART. *U. S. Patent Office, and "The Portland."*	1884, April 19.
BEAN, TARLETON HOFFMAN, M. D. *Smithsonian Institution, and Summit Avenue, Lanier Heights.*	Orig. Member.
BENEDICT, JAMES EVERARD. *Smithsonian Institution. and 140 B Street, N.E.*	1883, Jan. 5.
BESSELS, EMIL. *The Cosmos Club.*	1881, Mar. 25.
BEYER, HENRY G., M. D., U. S. N. *Smithsonian Institution, and 1205 Connecticut Avenue, N. W.*	1881, Nov. 11.
BIGELOW, HORATIO RIPLEY, M. D. (*Absent.*)	1884, Jan. 11.
BIGELOW, ROBERT PAYNE. (*Absent.*)	1883, Mar. 2.
BIRNEY, HERMAN HOFFMAN. (*Absent.*) *1901 Harewood Avenue, Le Droit Park.*	1881, Jan. 14.
BIRNEY, Gen. WILLIAM. *1901 Harewood Avenue, Le Droit Park.*	1882, Jan. 20.
BLACKBURN, ISAAC WRIGHT, M. D. *Government Hospital for the Insane.*	1885, Nov. 14.
BRITTON, WILEY. *Quartermaster General's Office.*	1882, Nov. 24.
BROMWELL, JOSIAH ROBSON, M. D. *1138 Connecticut Avenue, N. W.*	1883, Dec. 14.
BROWN, JAMES TEMPLEMAN. (*Deceased.*)	Orig. Member.
BROWNE, JOHN MILLS, M. D., U. S. N. *Bureau of Medicine and Surgery, U. S. Navy, and "The Portland."*	1882, Nov. 24.
BRUNER, LAWRENCE. (*Absent.*) *West Point, Neb.*	1882, Dec. 22.
BRYAN, JOSEPH H., M. D., U. S. N. *1534 I Street, N. W.*	1883, Dec. 28.
BURGESS, EDWARD SANDFORD. *High School, and 810 12th Street, N. W.*	1883, Jan. 5.
BURNETT, SWAN MOSES, M. D. *1215 I Street, N. W.*	1882, Mar. 17.

ACTIVE MEMBERS—Continued.	Date of Election.
BUSEY, SAMUEL CLAGETT, M. D. *901 16th St., N. W.*	Orig. Member.
CHAMBERS, PAUL, M. D. *1001 11th Street, N. W.*	1885, April 4.
CHAPPEL, JOHN WILLIAM, M. D. *Tennallytown, D. C.*	1883, Jan. 19.
CHASE, HENRY SANDERS, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
CHESTER, COLBY M., Commander, U. S. N. (*Absent.*) *Navy Department.*	1883, April 27.
CHICKERING, Prof. JOHN WHITE, Jr. *National Deaf-Mute College, Kendall Green, N.E.*	Orig. Member.
CHICKERING, JOHN JAMESON. *Kendall Green, N.E.*	1881, May 20.
CHRISTIE, ALEXANDER SMYTH. *U. S. Coast Survey Office, and 507 Sixth Street, N. W.*	1882, Mar. 17.
CLARK, ALONZO HOWARD. *U. S. National Museum, and 1527 S Street, N. W.*	1881, Jan. 28.
COLLINS, JOSEPH WILLIAM. (*Absent.*) *Gloucester, Mass.*	1881, Feb. 23.
COMSTOCK, Prof. JOHN HENRY. (*Absent.*) *Cornell University, Ithaca, N. Y.*	Orig. Member.
CONANT, WOODBURY PAGE. (*Absent.*)	1881, Dec. 23.
COUES, ELLIOTT, M. D. *Smithsonian Institution, and 1726 N Street, N. W.*	Orig. Member.
COX, WILLIAM VAN ZANDT. *U. S. National Museum, and "Belmont," corner 14th Street and Boundary, N. W.*	1881, Nov. 11.
CURET, ALBERT. *U. S. National Museum, and 934 E Street, N. W.*	1884, Nov. 29.
CURTICE, COOPER. *Smithsonian Institution.*	1884, Dec. 27.
DALL, WILLIAM HEALEY. *Smithsonian Institution, and 1119 12th Street, N. W.*	1881, Jan. 28.
DEWEY, FREDERIC PERKINS. *U. S. National Museum, and Lanier Heights.*	1881, Nov. 11.
DOSH, FRANK BOWMAN. (*Deceased.*)	1882, Jan. 20.
DRESEL, HERMAN GEORGE, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Dec. 22.
DRURY, GEORGE A., M. D. *1105 C Street, N.E.*	1885, April 4.

ACTIVE MEMBERS—Continued.	Date of Election.
EARLL, ROBERT EDWARD. *Smithsonian Institution, and 1336 T Street, N. W.*	1881, Jan. 28.
EGGLESTON, Rev. NATHANIEL HILLYER. *U. S. Department of Agriculture.*	1884, May 17.
ELLIOTT, HENRY WOOD. *Smithsonian Institution, and Cleveland, Ohio.*	1881, Feb. 25.
ELLZEY, MASON GRAHAM, M. D. *1012 I Street, N. W.*	1881, Nov. 25.
ENTHOFFER, JOSEPH. *U. S. Coast Survey Office, and 68 I Street, N. W.*	1882, Oct. 27.
FERGUSON, THOMAS BARKER. "*The Richmond.*"	1881, Jan. 28.
FISHER, ALBERT KENRICK, M. D. *U. S. Department of Agriculture, and Sing Sing, N. Y.*	1885, Dec. 12.
FLETCHER, ROBERT, M. D. *Surgeon General's Office, and "The Portland."*	1881, Mar. 25.
FLINT, JAMES MILTON, M. D., U. S. N. *U. S. Fish Commission Steamer Albatross.*	1881, Feb. 11.
FOREMAN, EDWARD, M. D. (*Deceased.*)	1881, Dec. 9.
FOSTER, RICHARD. *Howard University.*	1883, April 13.
FOX, WILLIAM HENRY. (*Absent.*) *Rockwood, Roane Co., Tenn.*	1883, April 27.
FRANZONI, CHARLES WILLIAM, M. D. *810 H Street, N. W.*	1883, Dec. 14.
FRISTOE, Prof. EDWARD T. *Columbian University, and 1434 N Street, N. W.*	1883, Jan. 5.
GANNETT, HENRY. *U. S. Geological Survey, and 1881 Harewood Avenue, LeDroit Park.*	1881, Mar. 25.
GARRETT, LEROY MASON, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
GEARE, RANDOLPH ILTYD. *U. S. National Museum.*	1884, May 3.
GEDNEY, CHARLES DE FOREST. *U. S. Coast Survey Office, and 115 F Street, N.E.*	Orig. Member.
GIHON, ALBERT LEARY, M. D., U. S. N. *U. S. Naval Hospital.*	1881, Mar. 11.
GILBERT, GROVE KARL. *U. S. Geological Survey, and 1424 Corcoran Street, N. W.*	1882, April 28.

ACTIVE MEMBERS—Continued.	Date of Election.
GILL, THEODORE NICHOLAS, M. D. *The Cosmos Club, and 321 Four-and-a-half Street, N. W.*	Orig. Member.
GILPIN, GEORGE E., M. D. *Tennallytown, D. C.*	1883, Mar. 30.
GODWIN, HARRY P. *Office of "The Evening Star."*	1882, Nov. 24.
GOODE, GEORGE BROWN. *Smithsonian Institution, and Summit Avenue, Lanier Heights.*	Orig. Member.
GOODRICH, JOSEPH KING. (*Absent.*)	1882, Oct. 27.
GORE, Prof. JAMES HOWARD. *Columbian University, and 1305 Q Street, N. W.*	Orig. Member.
GRAY, WILLIAM M., M. D. *Army Medical Museum.*	1885, Dec. 12.
GURLEY, REVERE RANDOLPH, M. D. *3055 Q Street, N. W.*	1882, Nov. 24.
HAMILTON, JOHN B., M. D. *9 B Street, N. W.*	1882, Nov. 24.
HASSLER, FERDINAND AUGUSTUS, M. D. (*Absent.*) *Santa Aña, Los Angeles Co., Cal.*	Orig. Member.
HAWES, GEORGE WESSON. (*Deceased.*)	1881, Feb. 25.
HAWKES, WILLIAM HIMES, M. D. *1330 New York Avenue, N. W.*	1882, Feb. 3.
HAYDEN, EDWARD EVERETT. *U. S. Geological Survey, and 1601 S Street, N. W.*	1882, Feb. 17.
HEIDEMANN, OTTO. *U. S. Department of Agriculture.*	1885, April 4.
HENSHAW, HENRY WETHERBEE. *Bureau of Ethnology, Smithsonian Institution, and 13 Iowa Circle.*	1882, Mar. 31.
HESSEL, RUDOLPH. *514 Tenth Street, N. W.*	1881, Jan. 14.
HILL, ROBERT THOMAS. *Smithsonian Institution.*	1886, Jan. 23.
HITCHCOCK, ROMYN. *Smithsonian Institution.*	1883, Nov. 16.
HOADLY, FREDERICK H., M. D. (*Absent.*)	1882, Dec. 22.
HOFFMAN, WALTER JAMES, M. D. *Bureau of Ethnology, and 222 E Street, N. W.*	Orig. Member.
HORNADAY, WILLIAM TELL. *U. S. National Museum, and 404 Spruce Street, LeDroit Park.*	1882, April 14.
HOUGH, FRANKLIN BENJAMIN. (*Deceased.*)	1882, May 26.

ACTIVE MEMBERS—Continued.	Date of Election.
HOUGH, MYRON BEACH WARNER. (*Deceased.*)	1882, April 27.
HOWARD, LELAND O. *U. S. Department of Agriculture, and Oakland Avenue, Washington Heights.*	Orig. Member.
HOWE, FRANK T. *Office of "The National Republican," and 1438 Corcoran Street, N. W.*	1883, Feb. 6.
HOWLAND, EDWIN PERRY, M. D. *211 Four-and-a-half Street, N. W.*	1881, Feb. 25.
INGERSOLL, ERNEST. (*Absent.*) *New Haven, Conn.*	Orig. Member.
ISRAEL, GEORGE ROBERT. *High School.*	1882, Dec. 22.
JENKINS, THORNTON A., Rear Admiral, U. S. N. *2115 Pennsylvania Avenue, N. W.*	1885, Feb. 22.
JOHNSON, ARNOLD BURGES. *Office U. S. Light-House Board, and 501 Maple Avenue, LeDroit Park.*	1882, Mar. 3.
JOHNSON, BLANCHARD FREEMAN. (*Deceased.*)	1882, Jan. 20.
JOHNSON, JOSEPH TABER, M. D. *926 17th Street, N. W.*	1882, Feb. 3.
JOHNSON, WILLARD DRAKE. (*Absent.*)	1884, Feb. 23.
JOHNSTON, WILLIAM WARING, M. D. *1603 K Street, N. W.*	1882, Nov. 24.
JOUY, PIERRE LOUIS. (*Absent.*)	Orig. Member.
KIDDER, JEROME HENRY, M. D. *Smithsonian Institution, and 1816 N Street, N. W.*	Orig. Member.
KING, ALBERT FREEMAN AFRICANUS, M. D. *726 13th Street, N. W.*	Orig. Member.
KNOWLTON, FRANK HALL. *U. S. National Museum, and 202 5th Street, S. E.*	1884, Nov. 29.
KOEBELE, ALBERT. (*Absent.*) *Alameda, Cal.*	1881, Nov. 25.
LAMASURE, GEORGE MORTON. *216 12th Street, S. W.*	1885, May 30.
LEE, THOMAS. *Smithsonian Institution.*	1884, Dec. 27.
LEE, WILLIAM, M. D. *2111 Pennsylvania Avenue, N. W.*	Orig. Member.
LEHNERT, Rev. ERNEST. *320 Four-and-a-half Street, S. W.*	1882, Jan. 20.
LUCAS, FREDERIC AUGUSTUS. *U. S. National Museum.*	1882, Oct. 27.
LUGGER, OTTO. *U. S. Department of Agriculture, and 429 N. Carey Street, Baltimore, Md.*	1885, Nov. 14.

ACTIVE MEMBERS—Continued.	Date of Election.
McArdle, Thomas Eugene, M. D. *707 12th Street, N. W.*	1882, Dec. 22.
McClain, Charles Sumner, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1883, Dec. 28.
McConnell, James Culbertson, M. D. (*Absent.*)	1883, April 27.
McDonald, Marshall. *Office U. S. Fish Commission.*	1881, Jan. 28.
McElhone, James Francis. *1318 Vermont Ave., N. W.*	1883, April 13.
McGee, W. J. *U. S. Geological Survey, and 1424 Corcoran Street, N. W.*	1883, Dec. 14.
McMurtrie, Prof. William. (*Absent.*) *Illinois Industrial University, Champaign, Ill.*	1881, May 20.
Mann, Benjamin Pickman. *U. S. Department of Agriculture, and 924 19th Street, N. W.*	1881, Nov. 11.
Marcou, John Belknap. *U. S. Geological Survey.*	1883, Nov. 3.
Marsh, Charles Carrolton, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
Marx, George, M. D. *U. S. Department of Agriculture, and 924 Mass. Ave., N. W.*	Orig. Member.
Mason, Otis Tufton. *U. S. National Museum, and 1305 Q Street, N. W.*	Orig. Member.
Merriam, Clinton Hart, M. D. *Smithsonian Institution.*	1885, Nov. 14.
Miller, Benjamin. *1516 31st Street, N. W.*	1881, June 3.
Miner, Randolph Huntington, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
Moser, Jefferson Franklin, Lieut., U. S. N. *Office U. S. Coast Survey.*	1884, April 5.
Murdoch, John. *U. S. National Museum, and 1441 Chapin Street, College Hill.*	1883, Nov. 30.
Murrell, Edward H., M. D. *Lynchburg, Va.*	1885, Nov. 14.
Nelson, Edward W. (*Absent.*)	1881, Dec. 9.
Nelson, Henry Clay, M. D., U. S. N. *Westminster, Md.*	1883, Feb. 2.
Niblack, Albert Parker, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1883, Jan. 19.

ACTIVE MEMBERS—Continued.	Date of Election.
NICHOLS, HENRY E., Lieut.-Comdr., U. S. N. (*Absent*). *Navy Department.*	1884, April 19.
NORRIS, BASIL, M. D., U. S. A. (*Absent.*) *Vancouver, Clarke County, Washington Territory.*	Orig. Member.
PARKER, PETER, JR. *Smithsonian Institution, and 2 Lafayette Square, N. W.*	1882, Dec. 22.
PATTON, HORACE B. (*Absent.*)	1882, Dec. 22.
PATTON, WILLIAM HAMPTON. (*Absent.*)	Orig. Member.
PERGANDE, THEODORE. *U. S. Department of Agriculture, and 614 7th Street, S. W.*	Orig. Member.
PERSONS, REMUS CHARLES, M. D., U. S. N. (*Absent.*) *Navy Department.*	1883, Feb. 16.
PHILLIPS, LOUIS E. *1428 New York Avenue, N. W.*	1883, Nov. 16.
PORTER, JOHN HAMPDEN, M. D. *2720 M Street, N. W.*	Orig. Member.
POWELL, Major JOHN WESLEY. *U. S. Geological Survey, and 910 M Street, N. W.*	1881, Feb. 11.
PRENTISS, DANIEL WEBSTER, M. D. *1224 9th Street, N. W.*	Orig. Member.
RATHBUN, RICHARD. *Smithsonian Institution, and 1622 Massachusetts Avenue, N. W.*	Orig. Member.
RAU, CHARLES. *Smithsonian Institution.*	1881, May 20.
REYBURN, ROBERT, M. D. *2129 F Street, N. W.*	1881, Dec. 9.
RHEES, WILLIAM JONES. *Smithsonian Institution.*	1882, Oct. 27.
RICHEY, STEPHEN OLIN, M. D. *1426 New York Avenue, N. W.*	1882, Mar. 17.
RIDGWAY, ROBERT. *Smithsonian Institution, and 1214 Virginia Avenue, S. W.*	Orig. Member.
RILEY, CHARLES VALENTINE. *U. S. Department of Agriculture, and 1700 13th Street, N. W.*	Orig. Member.
RUSSELL, ISRAEL COOK. *U. S. Geological Survey, and 1424 Corcoran Street, N. W.*	1882, April 28.
RYDER, JOHN ADAM. *Smithsonian Institution.*	1882, Mar. 31.
SAFFORD, WILLIAM EDWIN, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Nov. 24.

ACTIVE MEMBERS—Continued.	Date of Election.
SALMON, Dr. DANIEL ELMER. *U. S. Department of Agriculture.*	1883, May 25.
SAYLES, IRA. *U. S. Geological Survey.*	1884, May 3.
SCHÆFFER, EDWARD MARTIN, M. D. *1321 F Street, N. W.*	Orig. Member.
SCHÖNBORN, HENRY. *213 7th Street, N. W.*	1882, Jan. 20.
SCHUERMANN, CARL WILHELM. *Smithsonian Institution, and 916 D Street, S. W.*	1882, Mar. 11.
SCHWARZ, EUGENE AMANDUS. *U. S. Department of Agriculture, and 600 M Street, N. W.*	Orig. Member.
SCRIBNER, FRANK LAMSON. *U. S. Department of Agriculture.*	1885, Dec. 26.
SCUDDER, CHARLES WILLIS. *Office U. S. Fish Commission, and 1115 S Street, N. W.*	1881, Jan. 14.
SCUDDER, NEWTON PRATT. *Smithsonian Institution.*	Orig. Member.
SEAMAN, WILLIAM HENRY. *1424 11th Street, N. W.*	Orig. Member.
SEATON, CHARLES W. *(Deceased.)*	1882, May 26.
SHUFELDT, ROBERT WILSON, M. D., U. S. A. *(Absent.) Box 144, Smithsonian Institution.*	1881, Nov. 11.
SHUTE, DANIEL KERFOOT, M. D. *916 12th Street, N. W.*	1882, Feb. 17.
SMILEY, CHARLES WESLEY. *Office U. S. Fish Commission, and 943 Mass. Avenue, N. W.*	Orig. Member.
SMILLIE, THOMAS WILLIAM. *U. S. National Museum.*	1883, Mar. 2.
SMITH, DEXTER A. *816 14th Street, N. W.*	1885, April 4.
SMITH, JOHN B. *U. S. National Museum.*	1885, Nov. 14.
SMITH, THEOBALD, M. D. *U. S. Department of Agriculture.*	1884, Feb. 8.
SMITH, THOMAS CROGGON, M. D. *1133 12th Street, N. W.*	1883, Feb. 16.
SMITH, WILLIAM ROBERT. *U. S. Botanical Garden.*	1881, Nov. 11.
SNELL, Hon. WILLIAM B. *941 K Street, N. W.*	1885, May 16.
STEARNS, ROBERT EDWARDS CARTER. *Smithsonian Institution, and 1635 13th Street, N. W.*	1884, Nov. 29.
STEJNEGER, LEONHARD. *Smithsonian Institution.*	1881, Nov. 11.

ACTIVE MEMBERS—Continued.	Date of Election.
STERNBERG, GEORGE MILLER, M. D., U. S. A. (*Absent.*)	1881, Mar. 25.
STEVENSON, JAMES. *U. S. Geological Survey, and 1913 N Street, N. W.*	1882, Mar. 17.
STEWART, ALONZO HOPKINS. *204 4th Street, S.E.*	1883, Dec. 14.
STIMPSON, WILLIAM GORDON. *U. S. National Museum.*	1881, Feb. 25.
STREETS, THOMAS HALE, M. D., U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
TARR, RALPH STOCKMAN. (*Absent.*)	1882, Nov. 24.
TAYLOR, JAMES HEMPHILL. *482 Louisiana Avenue, N. W.*	1882, Dec. 22.
TAYLOR, THOMAS, M. D. *U. S. Department of Agriculture, and 238 Massachusetts Avenue, N.E.*	Orig. Member.
TAYLOR, WILLIAM BOWER. *Smithsonian Institution, and 306 C Street, N. W.*	1882, Oct. 27.
THOMAS, CYRUS. *Bureau of Ethnology, Smithsonian Institution.*	1883, Jan. 5.
THOMPSON, JOHN FORD, M. D. *904 14th Street, N. W.*	1881, Dec. 9.
TODD, Prof. JAMES EDWARD. (*Absent.*) *Tabor College, Tabor, Iowa.*	1881, Jan. 28.
TONER, JOSEPH MEREDITH, M. D. *615 Louisiana Avenue, N. W.*	Orig. Member.
TRUE, FREDERICK WILLIAM. *U. S. National Museum, and 1335 N Street, N. W.*	Orig. Member.
TUPPER, JAMES BRAINERD TAYLOR. *Internal Revenue Bureau, Treasury Department, and 510 I Street, N. W.*	1883, Nov. 30.
TURNER, HENRY W. (*Absent.*)	1882, Oct. 27.
TURNER, LUCIEN M. *Smithsonian Institution.*	1881, Dec. 23.
ULKE, HENRY. *411 15th Street, N. W.*	Orig. Member.
UPHAM, EDWIN PORTER. *Smithsonian Institution.*	1881, Mar. 25.
VASEY, Dr. GEORGE. *U. S. Department of Agriculture, and 2012 14th Street, N. W.*	Orig. Member.
WALCOTT, CHARLES DOOLITTLE. *U. S. National Museum.*	1883, Nov. 3.

ACTIVE MEMBERS—Continued.	Date of Election.
WARD, LESTER FRANK. *U. S. National Museum, and 1464 Rhode Island Avenue, N. W.*	Orig. Member.
WEST, HENRY LITCHFIELD. *Office of the "Washington Post," and 111 E Street, N. W.*	1882, Dec. 22.
WHITE, CHARLES ABIATHAR. *U. S. National Museum, and 312 Maple Avenue, LeDroit Park.*	Orig. Member.
WHITE, CHARLES HENRY, M. D., U. S. N. *Museum of Hygiene, and 1744 G Street, N. W.*	1883, Dec. 14.
WHITE, MAURICE PUTNAM. (*Absent.*)	1881, May 20.
WILLCOX, JOSEPH. (*Absent.*) *Media, Penn.*	1884, Dec. 27.
WILLIAMS, ALFRED. *Department of State, and 232 North Capitol Street.*	1881, Jan. 28.
WILSON, JOSEPH MCMINN. *1108 Maryland Avenue, S. W.*	Orig. Member.
WILSON, Hon. WILLIAM LYNE, M. C. *1008 N Street, N. W.*	1884, Mar. 22.
WINSLOW, FRANCIS, Lieut., U. S. N. (*Absent.*) *Navy Department.*	1881, Dec. 9.
WORTMAN, JACOB L. *Army Medical Museum.*	1884, April 19.
YARROW, HENRY CRÉCY, M. D. *Surgeon-General's Office, and 814 17th Street, N. W.*	Orig. Member.
YEATES, WILLIAM SMITH. *U. S. National Museum, and 1403 6th Street, N. W.*	1881, Feb. 25.
ZUMBROCK, ANTON. *455 C Street, N. W.*	1882, Jan. 6.

THE BIOLOGICAL SOCIETY OF WASHINGTON.

CONSTITUTION.

Adopted December 3, 1880.

ARTICLE I.

Name.

The name of this Society shall be "THE BIOLOGICAL SOCIETY OF WASHINGTON."

ARTICLE II.

Objects.

Its objects shall be to encourage the study of the Biological Sciences, and to hold meetings at which papers shall be read and discussed.

ARTICLE III.

[As amended January 10, 1885.]

Members.

The Society shall consist of active, corresponding, foreign, and honorary members. Candidates for membership shall be proposed to the Council, in writing, by at least three members, and, upon recommendation of the majority of the Council present at its regular meeting, shall be balloted for at the earliest ensuing meeting. A majority vote of the members present when the ballot is taken shall be necessary to election.

ARTICLE IV.

[As amended January 10, 1885.]

Officers.

The officers shall be a President, four Vice-Presidents, two Secretaries, and a Treasurer. There shall be a Council, consisting of the officers of the Society and five members, to be elected

by the Society. A quorum of the Council shall consist of seven members. Its duties shall be to act on nominations for membership, have the direction of the finances, audit the accounts of the Treasurer, and provide a programme for each meeting of the Society.

The officers shall be elected by ballot at each annual meeting, and shall serve one year, or until their successors are elected.

Presidents of the Society shall be members of the Council after the expiration of their term as President, without election thereto, in addition to the members of the Council otherwise provided for by the Constitution.

Article V.

President and Vice-Presidents.

The President, or, in his absence, one of the Vice-Presidents, shall preside at meetings of the Society and Council. The presiding officer shall appoint all committees in the Council and in the Society, unless otherwise ordered. It shall be the duty of the retiring President to deliver an address at the second meeting in January.

Article VI.

Secretaries.

The Secretaries shall take and preserve correct minutes of the proceedings of the Society and Council and a record of the members, shall conduct its correspondence, give due notice of all meetings, and inspect and count all ballots.

Article VII.

Treasurer.

The Treasurer shall have charge of all money and other property of the Society, and shall make disbursements under the direction of the Council. He shall collect all fees and assessments, and notify members who may be in arrears.

Article VIII.

Sections.

Sections for special work in any department of Biology may be formed upon the recommendation of the Council.

Article IX.

Meetings.

Stated meetings shall, unless otherwise ordered, be held on Friday of each alternate week, at eight o'clock P. M. The annual meeting for the election of officers shall be the first meeting in January. Special and field meetings may be called by the Council.

Article X.

[As amended February 2, 1883.]

Fees.

The initiation fee shall be one dollar; the annual fee two dollars. Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls, except in the case of those absent from the city for a year or more, who may be retained on the list as non-resident members during their absence. No member in arrears shall be entitled to vote at the annual meeting for the election of officers.

Article XI.

Amendments to the Constitution.

The Constitution of the Society may be amended by a two-thirds vote of the members present at any regular meeting, after at least four weeks' notice.

Article XII.

Order of Business.

The order of business at each regular meeting, unless otherwise provided by the Council, shall be as follows:

I. Reading of minutes.
II. Reports of Committees
III. Balloting for members.
IV. Nominations for membership.
V. Miscellaneous business.
VI. Reading of papers, discussions, and exhibition of specimens.

Article XII may be suspended at any time by a two-thirds vote of the members present.

PROCEEDINGS.

Sixty-Sixth Meeting, November 1, 1884.

The President occupied the chair, and thirty-five members were present.

The President announced the death during the summer intermission of Mr. Blanchard F. Johnson and Mr. M. B. W. Hough, active members of the Society.

He also gave notice that those present were invited to partake, at the close of the meeting, of a collation that had been spread in an adjoining room. It was explained that a number of members were desirous of introducing this new feature at the meetings of the Society, in order to promote social, as well as scientific, intercourse between the members, and that a committee had been appointed to report upon the subject.

Mr. William H. Dall made a communication upon the Zoological Position of Turbinella,* stating as his conclusions that *Turbinella* proper, as typified by *T. pyrum*, was closely related to the group typified by *Cynodonta cornigera;* and that the investigation of the soft parts, hitherto unknown, corroborated previous conclusions from the shell.

Dr. T. H. Bean exhibited specimens of A Chimærid Fish New to the Western Atlantic, obtained from deep water during the summer of 1884 by the Fish Commission Steamer Albatross, and explained its relations to described species.

Mr. John A. Ryder, in a paper entitled The Development of the Sunfish, Mola,† stated his belief that *Molacanthus* was merely a stage in the development of *Mola*.

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* 1885. Dall, W. H. *On Turbinella pyrum, Lamarck, and its dentition.* <Proc. U. S. Nat. Mus., viii, pp. 345–348, pl. xix.

† Chapter viii of a paper entitled *On the Origin of Heterocercy and the Evolution of the Fins and Fin-rays of Fishes.* (In press).

Sixty-Seventh Meeting, November 15, 1884.

The President occupied the chair, and forty members were present.

Mr. A. B. Johnson exhibited a collection of plants obtained by Sergeant Connell, a member of the Greely Expedition, at Fort Conger, lat. 81° 44′ N., long. 64° 45′ W. Dr. Vasey offered provisional identifications of the seven species as follows: *Ranunculus* (perhaps *R. Nelsoni*), *Potentilla*, sp., *Vesicaria* (perhaps *V. arctica*), *Calandrina*, sp., a species of the family Portulacaceæ, a fern, and a moss (perhaps *Bryum*, sp.).

Prof. Theodore Gill made a communication upon The Classification of the Monotremata,* sketching the history of opinion concerning their affinities, and calling attention to the fact that their oviparity had been recorded as early as 1822, by Fleming.

Prof. C. V. Riley read a paper on The Phytophagic Habit in Isosoma,† giving a historical and critical review of past opinion, and claiming to have finally demonstrated the life history of the Isosoma and its allies.

Mr. F. W. True spoke of his recent studies of The Habits of the Bottle-nose Dolphin,‡ and of the porpoise fisheries of Cape May and Cape Hatteras, which he had visited.

Sixty-Eighth Meeting, November 29, 1884.

The President occupied the chair, and forty-four members were present.

A communication was received from the Secretary of the Philosophical Society of Washington, inviting the members of the Biological Society to be present on the occasion of an address

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* 1884. Gill, Theodore. *The Eggs of Ornithorhynchus.* <Science, iv, pp. 452–453.

† 1885. Riley, C. V. *The Larger Wheat-straw Isosoma, Isosoma grande, Riley.* <Rept. [U. S.] Commiss. Agric. for 1884 (1885). (Riley, C. V. Report of the Entomologist, [Jan.] 1885), pp. 357, 358 [73–74], pl. 7, fig. 2, 3; pl. 8, fig. 3, 4.

‡ 1885. Science, v, p. 338, 1 fig.

by the president, Dr. J. C. Welling, at the annual meeting of that Society. The invitation was accepted.

Dr. W. K. Brooks, of Johns Hopkins University, made a communication upon THE ORIGIN OF ALTERNATION OF GENERATION IN THE HYDRO-MEDUSÆ.*

Mr. Sanderson Smith, of New York, read a paper entitled THE RECENT EXPLORATIONS OF THE STEAMER ALBATROSS, WITH SPECIAL REFERENCE TO THEIR GEOLOGICAL TEACHINGS.

SIXTY-NINTH MEETING, December 13, 1884.

The President occupied the chair, and thirty-six members were present.

The following communications were made.

Mr. Leonhard Stejneger, THE SHEDDING OF THE BILL IN AUKS.†

Dr. George Vasey, THE GRASSES OF THE ARID PLAINS, an account of observations during a recent trip to the western part of the United States.

Mr. C. D. Walcott, THE OLDEST KNOWN FAUNA ON THE AMERICAN CONTINENT,‡ a description of the characteristic fossils of the Primordial Group, of St. John, New Brunswick.

Prof. L. F. Ward, THE OCCURRENCE OF THE SEVENTEEN-YEAR LOCUST IN VIRGINIA, IN OCTOBER, 1884,§ and ADDITIONS TO THE FLORA OF WASHINGTON DURING 1884.‖ In his second

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* Abstract of a memoir entitled *The Life History of the Hydro-Medusæ; a Discussion of the Origin of the Medusæ, and of the Significance of Metagenesis*, now in course of publication by the Boston Society of Natural History.

† 1885. <Results of Ornithological Explorations in the Commander Islands and Kamtschatka, by Leonhard Stejneger. Bulletin of the U. S. National Museum, No. 29, Washington, 1885, pages 25–62, pls. i–v.

‡ 1884. WALCOTT, CHARLES D. On the Cambrian Faunas of North America. Preliminary Studies. Review of the Fauna of the Saint John Formation contained in the Hartt Collection at Cornell University. Bull. U. S. Geological Survey, No. 10; Washington, 8vo., pp. 56, pls. i–x.

§ 1885. WARD, LESTER F. *Premature Appearance of the Periodical Cicada.* <Science, v, June 12, p. 476.

‖ 1886. Proc. Biol. Soc. Washington, viii, p. 106.

communication, Prof. Ward announced that the names of 18 plants had been added to the Flora Columbiana during the past year, some of these having been new discoveries, and others based upon earlier observations, to which his attention had first been called during 1884.

SEVENTIETH MEETING, December 27, 1884.

The President occupied the chair, and thirty members were present.

Dr. Charles Sedgwick Minot, Secretary of the Society of Naturalists of the Eastern United States, made a statement concerning the annual meeting of that Society, to be held in Washington, on Monday and Tuesday of the following week.

Prof. R. E. C. Stearns, Dr. H. G. Beyer, and Mr. Benjamin Miller were appointed a committee to audit the accounts of the Treasurer, on account of his expected absence from the city after January 1.

Mr. F. W. True read a paper respecting A NEW SPECIES OF PORPOISE, PHOCÆNA DALLI, FROM ALASKA.*

Mr. John A. Ryder made a communication upon THE DEVELOPMENT OF THE FIN-RAYS IN FISHES.†

Mr. John Murdoch exhibited A COLLECTION OF MARINE INVERTEBRATES OBTAINED BY LIEUT. A. W. GREELY, AT CAMP CLAY, CAPE SABINE, SMITH SOUND,‡ all of which were well known Arctic forms.

Mr. G. Brown Goode spoke upon THE NATURAL HISTORY FEATURES AT THE WORLD'S EXPOSITION AT NEW ORLEANS.

SEVENTY-FIRST MEETING, January 10, 1885.

(Fifth Annual Meeting).

The President occupied the chair, and thirty-nine members were present.

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* 1885. TRUE, FREDERICK W. *On a New Species of Porpoise, Phocæna Dalli, from Alaska.* <Proc. U. S. Nat. Mus., viii, pp. 95–98, pls. ii–v.

† 1885. RYDER, JOHN A. *The Development of the Rays of Osseous Fishes.* <Am. Naturalist, Feb., pp. 200–204.

‡ Abstract in The Pastime, Washington, vol. iii, No. 7, p. 11, 1885.

The following amendments to the Constitution were unanimously adopted:

Article III, of members; the first sentence to be altered by the addition of the word "foreign," and to read as follows: The Society shall consist of active, corresponding, foreign, and honorary members.

Article IV, of officers; to insert the following sentence: Presidents of the Society shall be members of the Council after the expiration of their term as President, without election thereto, in addition to the members of the Council otherwise provided for by the Constitution.

The Society then proceeded to ballot for officers for the ensuing year, with the following results:

President—Mr. G. Brown Goode.

Vice-Presidents—Prof. Charles V. Riley, Prof. Lester F. Ward, Mr. William H. Dall, Prof. Otis T. Mason.

Secretaries—Mr. Richard Rathbun, Dr. Frank Baker.

Treasurer—Mr. Frederick W. True.

Additional Members of the Council—Dr. J. H. Kidder, Mr. C. D. Walcott, Mr. Romyn Hitchcock, Dr. George Vasey, Mr. J. L. Wortman.

Seventy-Second Meeting, January 24, 1885.

The fifth anniversary meeting was held in the lecture-room of the National Museum, the President, Mr. Goode, in the chair, and about one hundred persons present.

The retiring President, Dr. White, delivered an address upon The Relation of Biology to Geological History,* at the close of which, on motion of Mr. Dall, seconded by Prof. Mason and Prof. Ward, a vote of thanks was tendered him for his excellent communication, and for the very acceptable manner in which he had conducted the affairs of the Society during the past two years.

Seventy-Third Meeting, February 7, 1885.

The President occupied the chair, and twenty-five members were present.

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*1885. Proc. Biol. Soc., iii, pp. 1–20.

Mr. True announced that at the next meeting he would move to reconsider the day of meeting of the Society.

Mr. John A. Ryder made a communication upon THE PROBABLE ORIGIN AND HOMOLOGIES OF THE FLUKES OF CETACEANS AND SIRENIANS.*

SATURDAY LECTURES, 1885.

The fourth course of Saturday Lectures, under the auspices of the Biological Society and the Anthropological Society, was begun February 7, 1885. The lectures were delivered in the lecture room of the National Museum, and the following programme was carried out:

February 7: Prof. JOHN FISKE. Results in England of the Surrender of Cornwallis.

February 14: Dr. GEORGE M. STERNBERG, U. S. A. Germs and Germicides.

February 28: Hon. EUGENE SCHUYLER. The Machinery of our Foreign Service.

March 7: Mr. WILLIAM T. HORNADAY. Natural History and People of Borneo.

March 14: Mr. CHARLES D. WALCOTT. Searching for the First Forms of Life.

March 21: President E. M. GALLAUDET. The Language of Signs and the Combined Method of Instructing Deaf-Mutes.

March 28: President JAMES C. WELLING. Oldest History in the Light of Newest Science.

April 4: Mr. FREDERICK W. TRUE. Ornithorhynchus; a Mammal that Lays Eggs.

April 11: Dr. A. L. GIHON, U. S. N. Sanitary Ignorance among High and Low.

April 18: Mr. J. S. DILLER. A Trip to Mt. Shasta, California.

April 25: Dr. D. E. SALMON. Our Invisible Enemies, the Plagues of Animal Life.

May 2: Prof. T. C. MENDENHALL. Weighing the Earth.

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*1885. Amer. Naturalist, vol. xix (May), pp. 515–519. (Abstract).

SEVENTY-FOURTH MEETING, February 21, 1885.

The President in the chair, and ten members present.

Dr. H. G. Beyer, U. S. N., read a paper upon THE GENITAL APPARATUS OF LINGULA.*

Mr. J. L. Wortman described A METHOD OF EXHIBITING THE RELATIONSHIP OF THE BONES OF THE SKULL, the plan consisting in painting the bones with different colors.

Mr. F. W. True made some remarks on THE RECENT CAPTURE OF RIGHT WHALES ON LONG ISLAND.

SEVENTY-FIFTH MEETING, March 7, 1885.

Professor Ward, Vice-President, in the chair, and twenty-five members present.

Dr. C. A. White described THE USE OF GUTTA PERCHA IN MAKING CASTS OF FOSSILS.

Dr. H. G. Beyer, U. S. N., read a paper entitled REPORT ON INTRACELLULAR DIGESTION AND ITS RELATIONS TO PATHOLOGY.†

An informal ballot was taken to ascertain the sentiment of the members present with respect to the proposed change in the day of meeting, two-thirds of the members voting against the change. The Secretary was instructed to communicate with all the members of the Society in regard to this matter, and to report the result at a subsequent meeting.

SEVENTY-SIXTH MEETING, March 21, 1885.

Mr. Dall, Vice-President, occupied the chair, and twenty-eight members were present.

The following paper, by Mr. Robert Ridgway, submitted for publication in the Proceedings, was read by title: DESCRIPTIONS

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*1886. BEYER, H. G. *A Study of the Structure of Lingula (Glottidia) pyramidata Stim. (Dall.)* <Studies from the Biol. Lab. Johns Hopkins Univ., Baltimore, iii, No. 5, March, pp. 227–265, pls. xiii–xvii.

†1885. BEYER, H. G., Surg., U. S. N. *Abstract from an Article on Intracellular Digestion by Dr. Elias Metschnikoff.* <Monthly Jour. of Microscopy, vi, pp. 61–65.

OF SOME NEW SPECIES OF BIRDS FROM COZUMEL ISLAND, YUCATAN.*

Mr. W. H. Dall made a communication ON THE MARSUPIUM OF MILNERIA MINIMA,† a small Californian bivalve shell belonging to the family Cardilidæ.

Prof. J. W. Chickering, Jr., exhibited a series of drawings and paintings of the flowering plants of the Shenandoah Valley, made by Mr. William T. Allen, a farmer of Gaylord, Clark Co., Virginia.

Dr. T. H. Bean spoke of SOME FEATURES OF COLLECTING AT COZUMEL ISLAND, YUCATAN,‡ which he had recently visited, with the Fish Commission Steamer Albatross.

Mr. J. A. Ryder made a communication upon THE DEVELOPMENT OF THE MAMMARY GLANDS IN CETACEA,§ based upon recent studies of sections of a female embryo of the black fish (*Globiocephalus melas*), two inches long.

Prof. L. F. Ward described the PHYLLOTAXY OF PAULOWNIA IMPERIALIS, and made some remarks on the general subject of leaf arrangement.

SEVENTY-SEVENTH MEETING, April 4, 1885.

Prof. Ward, Vice-President, occupied the chair, and twenty members were present.

The chair announced that 107 replies had been received in response to the circulars sent out by the Secretary, asking expressions of opinion respecting the proposed change of meeting-day. The greater number indicated a preference for Friday and Saturday, the same number of votes (thirty-four) having been received in favor of each of those days. On motion of Mr. A. B. Johnson, action upon this question was indefinitely postponed.

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* 1885. Proc. Biological Society, iii, pp. 21–24.

† 1885. ORCUTT, CHARLES R. *Notes on the Mollusks of the vicinity of San Diego, Cal., and Todos Santos Bay, Lower California, with comments by W. H. Dall.* <Proc. U. S. Nat. Mus., viii, pp. 534–552, pl. xxiv.

‡ New York Times, May 3, 1885.

§ 1885. RYDER, JOHN A. *On the Development of the Mammary Glands of Cetacea.* <Am. Nat., xix (June), pp. 616–618. *On the Development of the Mammary Glands and Genitalia of the Cetacea.* <Bull. U. S. Fish Com., v, pp. 135–142, one figure in text.

The following communications were made:

Mr. Frank H. Knowlton, On Some Alaskan Willows and Birches collected by Mr. C. L. McKay, at Nushagak, in 1881.*

Dr. Frank Baker, Muscular Equilibration.

Dr. C. A. White, Some Remarks on Vegetable Cells.

Prof. W. H. Seaman stated that he had recently noticed in the Washington markets what is to this region a new species of tropical plant, known in New Orleans as the Japanese plum. The supplies had been received from Georgia. The fruit is indigenous to China and Japan, and in the former country is known as *Loo-Chee*.

Seventy-Eighth Meeting, April 18, 1885.

The President occupied the chair, and twenty-five members were present.

The President announced the recent death of Dr. Edward Foreman, a member of the Society, and appointed Messrs. White, Seaman, and Ward, a committee to prepare a report upon his services to science.

Dr. Theobald Smith read a paper, detailing Koch's Method of Isolating and Cultivating Bacteria, as used in the laboratory of the Bureau of Animal Industry.†

Mr. A. B. Johnson presented a communication upon The Ship-worm, Teredo navalis, and the Sheepshead, Archosargus probatocephalus. He exhibited sections of the piles of wharves, which had been gnawed by the sheepshead, in order to feed upon the teredos, thus aiding in the work of destruction which is sufficiently rapid when left to the latter species alone.

After adjournment, Mr. Romyn Hitchcock exhibited, under the microscope, a series of preparations showing the comma bacillus of cholera, according to Koch.

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* 1885. Knowlton, Frank H. *List of Plants collected by Mr. Charles L. McKay, at Nushagak, Alaska, in 1881, for the United States National Museum.* <Proc. U. S. Nat. Mus., viii, pp. 213–221.

† 1885. Salmon, D. E., and Smith, Theobald, Drs. *Koch's Method of Isolating and Cultivating Bacteria, as used in the Laboratory of the Bureau of Animal Industry, Dept. Agriculture.* <Am. Monthly Micro. Jour., vi, p. 81. (Abstract).

SEVENTY-NINTH MEETING, May 2, 1885.

The President occupied the chair, and twenty-eight members were present.

Dr. Thomas Taylor made a communication on THE WHITE RUST OF CABBAGES, CYSTOPUS CANDIDUS.

Mr. H. W. Henshaw read a paper entitled HYBRID QUAIL,* the case of hybridism presented being between the California Valley quail (*Lophortyx californicus*), and Gambel's quail (*Lophortyx Gambeli*).

Mr. W. H. Dall spoke of OBSERVATIONS MADE DURING A RECENT JOURNEY IN FLORIDA.

EIGHTIETH MEETING, May 16, 1885.

The President in the chair, and twenty-five members present.

Mr. F. W. True exhibited A SPECIMEN OF THE ADULT MALE GUEREZA MONKEY, COLOBUS GUEREZA, recently purchased by the National Museum, and made some remarks upon the coloration, geographical distribution, and habits of the species.

Dr. T. H. Bean exhibited specimens of A NEW GENUS AND SPECIES OF FISH FROM FLORIDA, RELATED TO MURÆNOIDES,† a genus known to occur only in temperate and Arctic regions.

Mr. J. L. Wortman presented a communication on THE REDUCTION OF THE MOLAR TEETH OF THE CARNIVORA.

Prof. O. T. Mason read a paper ON POST-MORTEM TREPANNING,‡ describing especially a specimen recently sent from Peru, by Dr. W. H. Jones, U. S. N., and considered by Prof. Mason to be the most remarkable example yet brought to light.

EIGHTY-FIRST MEETING, May 30, 1885.

The President in the chair, and thirty-two members present.

Prof. L. F. Ward, in a communication entitled RECENT FLOW-

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* 1885. HENSHAW, H. W. *Hybrid Quail (Lophortyx Gambeli x L. californicus).* <The Auk, vol. ii, No. 3, July, pp. 247–249.

† 1885. BEAN, TARLETON H. *On Stathmonotus, a new genus of fishes related to Muræenoides, from Florida.* <Proc. U. S. Nat. Mus., viii, pp. 191–192, pl. xiii.

‡ 1885. MASON, OTIS T. *The Chaclacayo Trephined Skull.* <Proc. U. S. National Museum, viii, pp. 410–412, pl. xxii.

ERING OF THE GINKGO TREE IN WASHINGTON,* stated that two trees of *Ginkgo biloba*, L., a male and a female, had flowered for the first time in the Botanical Garden, and the artificial pollinization of the female tree had been successfully effected.

Dr. H. G. Beyer, U. S. N., read a paper on THE PHYSIOLOGICAL EFFECTS OF COCAINE.†

Prof. C. V. Riley presented a paper entitled NOTES ON THE PERIODICAL CICADA,‡ in which he described the two extensive broods of this year, and discussed the specific value of the different forms.

Dr. Thomas Taylor made a communication on HOW TO DISTINGUISH BETWEEN ANIMAL AND VEGETABLE FATS,§ giving an account of his recent experiments on the subject.

EIGHTY-SECOND MEETING, October 31, 1885.

The President occupied the chair, and thirty members were present.

Col. Marshall McDonald made a communication entitled FISH CULTURE A NECESSITY FOR THE MAINTENANCE OF THE SHAD FISHERY,‖ illustrating his arguments by a comparison of the statistics for 1880 and 1885.

Mr. Wm. H. Dall read a paper on DEEP-SEA MOLLUSKS AND THE LAWS ILLUSTRATED IN THEIR DEVELOPMENT, exhibiting specimens collected by the Coast Survey Steamer "Blake" and the Fish Commission Steamer "Albatross."

Prof. O. T. Mason exhibited a series of casts taken from the

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*1885. WARD, LESTER F. *The Ginkgo Tree.* <Science, v, June 19, pp. 495–497, 10 figs.

†1885. BEYER, H. G. *The Influence of Atropine, Cocaine, and Caffeine on the Heart and Blood Vessels.* <Am. Jour. of the Medical Sciences, Phila., July, pp. 1–31, 2 pls.

‡1885. RILEY. C. V. *The Periodical Cicada.* <Science, v, June 26, pp. 518–521.

§Proc. Am. Assoc. Advancement of Science, 1885; Proc. Am. Soc. of Microscopists, 1885; Ann. Rept. U. S. Dept. of Agriculture, 1885.

‖1885. *The Results of Shad Propagation on the Atlantic Coast.* <Science, vi, No. 145, suppl., pp. 433–434. (Abstract). Abstracts also printed in the American Angler, Forest and Stream, and other papers.

surfaces of a set of Haidi gambling sticks, the carvings on which were illustrative of Haidi mythology.

EIGHTY-THIRD MEETING, November 14, 1885.

The President occupied the chair, and twenty-six members were present.

Mr. Richard Rathbun read a paper entitled REMARKS ON THE WOOD'S HOLL STATION OF THE U. S. FISH COMMISSION, in which he described the quarters recently constructed for the purposes of fish culture and investigation.

Dr. W. S. Barnard exhibited A NEW STYLE OF METAL CASE FOR MOUNTING NATURAL HISTORY SPECIMENS.

The cases are of different shapes and sizes, and without sharp angles to give greater strength. They are intended for both dry and fluid preparations, and may have a glass face on one side. They are so constructed as to receive a tablet on which the specimens may be mounted. The lid has a groove with soft packing, to prevent evaporation or the entrance of museum pests.

Mr. John A. Ryder described A NEW AND PRACTICAL SYSTEM OF RAISING SEED OYSTERS.*

Mr. F. W. True made a communication ON A SPOTTED DOLPHIN APPARENTLY IDENTICAL WITH PRODELPHINUS DORIS, GRAY,† basing his remarks upon a specimen recently taken off Cape Hatteras by the Fish Commission Steamer Albatross.

EIGHTY-FOURTH MEETING, November 28, 1885.

The President occupied the chair, and thirty-six members were present.

Letters were read from the Secretaries of the Philosophical Society and the Chemical Society, inviting the members of the Biological Society to attend the next meetings of those Societies, at which presidential addresses would be delivered.

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* 1885. Forest and Stream, XXV, No. 13, Oct. 22, pp. 249–250. Science, Nov. 28.

† TRUE, FREDERICK W. *On a Spotted Dolphin Apparently Identical with the Prodelphinus doris of Gray.* <Rept. U. S. National Museum for 1884, pp. 317–324.

Dr. Theobald Smith exhibited A Simple Device for Storing Cover-Glasses Illustrative of Bacterial Disease.

Dr. W. S. Barnard explained A New Method of Mounting Glass Specimen Tubes. Punched wads of some material that is proof against insects and fluids were recommended as stoppers for specimen tubes, being both economical and efficient. The tubes are mounted on tablets or labels by means of sheet-metal end clips which also serve to hold in the stopper; several different styles were exhibited.

Dr. C. Hart Merriam read a paper on The Work of the U. S. Department of Agriculture in Economic Ornithology.

Mr. C. D. Walcott made a communication upon Evidence of the Loss of Vital Force in Certain Trilobites on Approaching Extinction.

Mr. F. W. True presented A New Study of the American Pocket Rats, genus Dipodomys.

Eighty-Fifth Meeting, December 12, 1885.

The President occupied the chair.

Dr. J. M. Flint, U. S. N., read a paper entitled The Collection and Method of Studying Foraminifera, exhibiting representative specimens from the dredgings of the U. S. Fish Commission Steamer Albatross.

Mr. Romyn Hitchcock made a communication upon The Red Snow,* showing specimens derived from several sources.

Dr. W. S. Barnard spoke upon Environmental Digestion.

Prof. C. V. Riley presented a paper entitled The Mildews of the Grape Vine.†

Eighty-Sixth Meeting, December 26, 1885.

The President occupied the chair, and twenty-five members were present.

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* 1885. *The Red Snow.* <Am. Monthly Micr. Jour., vi, pp. 221–224.

† Riley, C. V. *The Mildews of the Grape Vine. An effectual remedy for the Peronospora.* <Rural New Yorker, Feb. 6, 1886, illustrated. (Also separate reprint).

The following communications were made:

Dr. C. Hart Merriam, Description of a new Species of Striped Squirrel, Tamias macrorhabdotes, from California;* and Description of a new Sub-Species of the Common Eastern Chipmunk, Tamias striatus lysteri.†

Mr. F. H. Knowlton, The Multiplication in the Gynoecium of Datura Stramonium.

Prof. O. T. Mason, Mutilations of the Human Body, Considered Ethnically.

Eighty-Seventh Meeting, January 9, 1886.

The President occupied the chair, and twelve members were present.

This meeting was called as the annual meeting for the election of officers, but, on account of the small number of members present, due to very inclement weather, it was voted to defer the election to the next regular meeting-day.

Eighty-Eighth Meeting, January 23, 1886.

(Sixth Annual Meeting).

The President occupied the chair, and twenty-eight members were present.

The following board of officers was elected for the ensuing year:

President—Mr. G. Brown Goode.

Vice-Presidents—Mr. William H. Dall, Prof. Charles V. Riley, Prof. Lester F. Ward, Dr. Frank Baker.

Secretaries—Mr. Richard Rathbun, Dr. C. Hart Merriam.

Treasurer—Mr. Frederick W. True.

Additional Members of the Council—Mr. Romyn Hitchcock, Mr. Charles D. Walcott, Dr. Tarleton H. Bean, Prof. Otis T. Mason, Dr. George Vasey.

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* 1886. Proc. Biological Society, iii, pp. 25–28.

† 1886. Merriam, C. Hart, M. D. *Description of a New Subspecies of the Common Eastern Chipmunk.* <Am. Nat., xx, pp. 236–242.

Eighty-Ninth Meeting, February 6, 1886.

The Sixth Anniversary Meeting of the Society was held this evening in the Lecture Hall of the National Museum, Mr. William H. Dall, Vice-President, presiding. The President, Mr. Goode, delivered the annual address, his subject being The Beginnings of Natural History in America.*

Many members of the other scientific societies of the city were present by invitation.

* 1886. Proc. Biological Society, iii, pp.35–105.

ADDRESSES AND COMMUNICATIONS.

THE APPLICATION OF BIOLOGY TO GEOLOGICAL HISTORY.*

By Charles A. White.

I have chosen the subject which has just been announced by the Chairman, because I have been so long identified with the geological and paleontological work of our country that I think you will naturally expect my retiring address to have reference to some subject connected with the biological history of the earlier ages of the earth. It has become customary upon occasions like the present for the speaker to select some subject relating to his own special lines of research; and it is often the case that such addresses are real contributions to science and records of its advancement, as indeed it is well that they should be; but after much hesitation I have decided that my remarks upon this occasion shall be of a somewhat opposite character. That is, I shall endeavor to show that certain prevalent ideas are erroneous, and, incidentally, how they have retarded rather than aided philosophical inquiry.

It is much pleasanter for one to record and announce the triumphs of long and patient research, and to show the evidence of a steady increase of knowledge in the branch of study to which he is devoted, than to point out the existence of errors in unexpected quarters. But it is well that we should pause occasionally in our labors and question the truth of every proposition upon

*Annual presidential address delivered at the Fifth Anniversary Meeting of the Society, January 24, 1885, in the lecture-room of the U. S. National Museum.

which we have been wont to act, and to inquire whether they will bear the light of rapidly increasing knowledge. I propose to-night not only to point out the insufficiency of the evidence which is relied upon to support some of the assumptions of paleontology, but to challenge the truth of some of the propositions which its leading men have been in the habit of treating as fixed laws of unquestionable and universal application, and to show that they are not in harmony with the facts of philosophical biology. I comprehend the danger that those who are not familiar with the leading principles of paleontology, hearing only a statement of the misconceptions which its votaries have fallen into, will be inclined to underestimate its fundamental truths, which are really unassailable. I wish to say, therefore, that I have no intention of treating my subject wantonly; and I shall be sorry to weaken the faith of any one in the general truths of a science which has done more than any other to broaden the minds of men as to the problems of animal and vegetable life; and which has a future before it, the brilliance of which is in no danger of being obscured.

The remarks which I am about to make refer mainly to certain errors, not yet entirely eliminated, which early obtained a foothold in paleontology, as a natural consequence of the biological opinions then prevailing, and which were inseparable from its stage of transition and growth. Modern paleontology, like the other sciences, has been a matter of growth; and errors once introduced have been found difficult to eradicate, even after an increase of knowledge has shown them to be such; and it is an unpleasant fact that our science, as it is now taught and practised, even by some of the best authors, is marred by some of its early defects.

The first and principal question which I propose to discuss relates to the chronological order of succession of animal and vegetable types, and their geographical distribution during their existence.

As aids to the correlation of the geological formations, fossils began early to be used. At first they were treated merely as tokens of the formations in which they occurred, without any reference to their character as representatives of formerly existing life; but it was soon perceived that by their use a systematic classification of the stratified rocks could be made. We now know that without their use we could not have obtained any adequate conception of geological history; and the present recognized scheme of the formations, or the geological scale, as it is sometimes called, could have never been devised. It is true that the order of succession of the few formations which may be favorably exposed in limited districts might have been made out by means of the lithological character of the strata alone; but the correlation of such limited groups of strata with those of other and distant districts would have been by such means impossible.

After the order of succession of the different groups of strata had been made out for certain regions and correlated with those of other regions, it began to appear that certain types of animal and vegetable remains characterized certain portions of the geological scale which was devised as a result of that correlation. That scale, which is the foundation of the one now in general use, was necessarily at first more or less defective and artificial. It has from time to time been much improved, and, although it is still imperfect, it is a marvellous monument of the results of inductive reasoning. Geology and biology have each come to the other's aid until not only has the foundation been substantially laid, but the structure itself is approaching completion in a perfect form.

In Europe, where geological science was first studied, and where it has ever since been prosecuted with remarkable energy, it was found that the chronological range of the types of fossils which characterize the respective formations is well defined. And when researches were extended into the adjacent parts of

Asia and Africa, the European standards were still found sufficiently exact for at least general conclusions. Even in Eastern North America the order of the formations and the types of the fossils which characterize them are closely like those of Western Europe, and in many cases the species are regarded as identical.

It was natural, then, that the conditions which were found to have formerly prevailed in those regions where geology was first studied should be held to have been the normal conditions for the whole earth. Such were the opinions formed by the earlier European geologists; and their successors still hold the European standard to be applicable to every region, and to every condition of climate which the earth has known. The leading idea which is embodied in this chronological scheme would, I think, be fairly illustrated by a diagram which may be constructed by taking such a section of the geological formations as is usually given in the text-books of geology, that of Dana's Manual for example, and projecting a series of circular lines from the boundary lines of each of its divisions and subdivisions. Let this series of circles represent approximately the time-equivalent of the geological column of formations and the assumed universal definition of each of its subdivisions.

It will of course be understood that such a diagram could not be intended to illustrate the time ratios of the different epochs, periods, and ages into which historic geology has been divided. It has been suggested only to illustrate the rigid character of the paleontological time-standard which European geologists have erected for themselves, and which they seek, with the consent of most of the geologists of other countries, to apply to the whole earth, even in minute detail.

It was formerly held that not only have all species of animals and plants been specially created, but that a majority of them became extinct during or at the close of each epoch; and that each period was closed with a universal catastrophe, by which

every living thing upon the earth was destroyed. Furthermore, that the whole earth, at the beginning of each successive period, was stocked anew by special creation, with all its forms of life; and that these forms were everywhere impressed with the type-characters peculiar to the respective epochs. Even after it became known that in numerous instances species and genera continued their existence from one period to another, it was still held that these were extra-limitary forms, and that their existence did not affect the exclusive character of the types of those animals and plants which were ordained to bear the chronological impress.

Accepting such a scheme of creation as this, it was natural to suppose that the types of animal and vegetable life which characterized each of the geological periods should be universal in its distribution, and strictly confined to the period for which it was specially created.

Although the doctrine of evolution is now accepted by every working naturalist, this idea of a successive series of narrow chronological horizons of universal extent, each characterized by its own peculiar types of organic forms, which are everywhere the same, and none of which exist in any other horizon, prevails to almost as great an extent as before. The later naturalists, it is true, based their views of this assumed constancy, not upon the idea of special creation and universal distribution in each period, as their predecessors did, but upon that of a progressive evolution, by distinct and world-wide steps, from pre-existing forms. The views which were held by the older naturalists were the result of a rational deduction from their own premises; but that similar views should be held by the naturalists of to-day is certainly unphilosophical. In accordance with the old views little opportunity was given for the variation of types, because, as they believed, all the species in which those types were expressed were sure to be extinguished at the close of each period, and they were to be succeeded by a newly-created series.

To the modern naturalist, a belief in the universal distribution, and narrow and rigidly restricted chronological range of organic types which characterize each successive epoch, implies that evolution has occurred in all instances in exactly the same mathematical ratio; for animal as well as vegetable forms; for aqueous as well as for terrestrial life; for the life of fresh waters as well as that of the seas; and under every environing condition of climate and of geological change. It implies the existence of some unknown and unexplainable law which, at the close of each epoch, required the utter and speedy extinction of exactly such types as had specially characterized those epochs, even if the physical conditions under which they had formerly existed had continued the same. That such ideas do prevail among paleontologists at the present time one has abundant proof in their published writings.

In Europe it was found that during the successive geological epochs certain types of plants and vertebrate and invertebrate animals all lived simultaneously; and the actual and relative rate of progress of evolution of the types in each of these great biological divisions, seeming to be a natural one, was regarded as under the influence of some cosmical law which necessarily made that rate uniform for the whole earth. When, therefore, even a single type, whether of plants or vertebrate or invertebrate animals, such as is known to characterize any European group of strata, has been found in any other part of the earth, it has been customary to hold that the animal or plant, as the case might be, which is represented by that type, existed simultaneously with its European congeners. Although the folly of relying upon such slender evidence has again and again been shown, it is not uncommon to see it presented in important paleontological publications with all the force that such words as "certainly," "undoubtedly," "unquestionably," &c., can give it.

I have made the foregoing statements, first, to call attention to the existence of the erroneous views which I have indicated; and, secondly, that they may serve as a suggestion of the reason

why they have obtained a foothold. I am confident that if the geological scheme had yet to be devised upon the basis of the advanced knowledge which naturalists have now acquired, it would be free from the defects which I have mentioned. In fact, it seems that these defects are due to the erroneous biological views which naturalists formerly entertained; and that they have remained solely because it is so difficult for men to free their minds from impressions which have once become firmly fixed, even after their fallacy has become apparent.

These errors have by no means escaped the attention of leading naturalists; and several years ago Prof. Huxley proposed the term "homotaxis" to express the existence of close biological relationship between formations in different parts of the world respectively, which might not, or could not, have been contemporaneously deposited. In using this term instead of "equivalent," "synchronous," &c., as has usually been done in relation to formations in separate regions which contain closely similar faunas or floras, one does not thus commit himself to any opinion as to the actual geological age of such formations, but only to the fact that the forms of life were similar when and where those formations were respectively deposited. Professor Huxley's idea may be represented graphically by superimposing upon the diagram which I have suggested a complementary series of lines, much as isothermal lines are superimposed upon a map with its lines of latitude. But to express the present state of our knowledge, these complementary or isotaxial lines must be sadly broken and fragmentary.

This idea of homotaxy necessarily has reference to some acknowledged standard of the order in which the geological formations have been deposited; and in using the term I shall of course have reference to that which is in general use, which is practically the European standard.

Various authors have shown, not only that many formations have been found in different parts of the world to be homotaxi-

ally related to each other by their respective faunas and floras which certainly were not contemporaneously deposited, but also that many foreign formations contain faunas which respectively embrace homotaxial representatives of two or more European formations. After I had selected the subject, and written out the greater part of these remarks, the address of Mr. W. T. Blanford and the article of Mr. J. Starkie Gardner, read before the British Association for the Advancement of Science, at Montreal, reached my hands. I find from a perusal of them that both of those gentlemen have so far anticipated much which I intended to say that I cordially recommend my hearers to read those productions. Both of them, especially that of Mr. Blanford, record some startling exceptions to the generally received rule that formations homotaxially related were of contemporaneous origin. I shall have occasion to refer to some of the cases of this character which they have mentioned, and I shall also cite other instances which have come under my own observation. First, I shall mention instances where there is apparent reversion of the chronological order of the formations, and afterward those in which a commingling in one formation of the characteristic types of two or more epochs occur.

Mr. Blanford, in his address, cites a considerable number of instances where the order of occurrence of faunal and floral types, according to the accepted chronological scale, is reversed. One of these instances occurs at the famous Pikermi beds, near the ancient city of Athens. These beds contain a rich mammalian fauna which is so characteristically Miocene that the French committee of the International Congress of Geologists specially mention it as of that age. Some of the species of the Grecian locality referred to are identical with those of some of the fully recognized Miocene strata of other parts of Europe. Now, Professor Gaudry found in the lowest of these Grecian beds which bear Miocene vertebrates several species of well-known Pliocene mollusca, and he also found that this bed in turn rests upon a "marine bed of undoubted Pliocene age."

A similar condition of things occurs among the Tertiary deposits along the southern base of the Himalayas in India, in what are known as the Siwalik beds. These beds contain a mammalian fauna which European paleontologists have unhesitatingly referred to the Miocene; but the geologists of the Indian survey have shown that they have many thousand feet of Miocene strata beneath them; and upon other grounds, also, they show that they cannot be of earlier age than the Pliocene.

Perhaps one of the most remarkable instances of the apparent reversion of the chronological order of the formations, as it is known in Europe, occurs in the great series of strata in India which is known as the Gondwána System. Mr. Blanford, in his address, gives an account of this remarkable case in detail. Certain of the beds of this system of formations contain a fauna which paleontologists agree in classifying as Triassic. These Triassic beds are found overlying beds which contain a Rhætic flora, or one which has its homotaxial representative in Europe between the Jurassic and Triassic; and these Rhætic beds are found to overlie those which contain a flora that paleobotanists refer with confidence to the Jurassic period. In the other cases mentioned, there is a reversion of two homotaxial epochs; but in this Gondwána System the reversion embraces three of them. That is, the order of all the three is reversed, so that the ascending order in India is the same as the descending order in Europe.

Again, it has been shown by experienced geologists that in Australia there are beds which bear a flora that paleobotanists declare to be typically Jurassic, and which are interstratified with marine beds that bear an abundance of characteristic Lower Carboniferous molluscan species. And, furthermore, that these beds are overlaid by a fresh-water formation which has been referred with confidence to the Permian period.

Coming to our own country, the most remarkable case of the reversion of the order in which the faunal and floral types are

found to characterize the European formations is found in the Cretaceous series of the valley of the Upper Missouri river. Here we have a series of strata which has been held to represent the European Cretaceous series from the Gault to the Upper Chalk, inclusive. In the lower division of this American series there has long been known to exist a flora which, when it was first discovered, was referred by the best authority to the age of the Eocene Tertiary. Even so late as the past year, Mr. J. Starkie Gardner has expressed the opinion that these plants are more likely to be of Eocene age than earlier. Now the strata containing this assumed Tertiary flora are overlaid by a series, several thousand feet in thickness, which contains an abundance of marine types that correspond with those of the Cretaceous of Europe. Indeed, several of the species are regarded as identical; and the types embrace reptiles, fishes, and cœlenterata, as well as all the classes of mollusca. Then, resting upon this series, and its Atlantic border equivalent, we find the whole Tertiary series, at least up to the close of the Miocene. Furthermore, a considerable number of these American Tertiary forms are usually regarded as identical with European Tertiary species. It would thus seem that both the stratigraphical and concurrent paleontological evidence are decidedly against the Tertiary age of that flora, and in favor of its Cretaceous age, notwithstanding its homotaxial relationship to the Tertiary flora of Europe.

The commingling of types in one formation which, in Europe, respectively characterize two or more separate formations, is a matter of not uncommon occurrence in America and other parts of the world. These cases occur where the order of the formations seems to agree well with that of the accepted European standard; and they apparently merely show that the types referred to began their existence earlier, or continued it later, as the case may be, than they were known to have done in Europe. In the other cases the discrepancies are seen to occur as between marine faunas on the one hand, and land faunas and floras on the

other; and those discrepancies amount to an actual reversion of the usual order. In the cases which I shall now mention, however, the discrepancies consist in either the actual or relative earlier introduction, or later continuation, of certain types among both marine and continental faunas and land floras, than is required by the European standards. In these latter cases there is of course a confusion of homotaxial relationship, of the formations which contain the commingled types, with other formations; but there is not necessarily any reversion of the order of occurrence of the types, as there is in the cases already mentioned.

I ought not in this connection to omit mention of the so-called colonies of Barrande, in Bohemia, which, as he contended, bear a marine Silurian fauna, alternating with strata which bear a Primordial one. But as the truth of Barrande's position has been seriously questioned, I need not discuss it in these remarks.

Even after what we have seen of the history of the received opinions concerning the synchronism of formations, it is still a somewhat remarkable fact that, although the blending of the faunas of certain formations into each other by the commingling of types, which are regarded as characteristic of each respectively, has been so long known and so often demonstrated, that the idea of universal restriction of types to narrow time-horizons should be so persistently held. Indeed, the fact that such a commingling of types as I have referred to has been so well recognized that it has made its impress upon the terminology of geology. Thus the term Permo-Carboniferous has long been used in America to designate strata which partake of both Coal-Measure and Permian characteristics; and the same term has been applied by Dr. Toula to strata which bear a similar fauna on the island of Spitzbergen.

The terms Cretaceo-Jurassic and Cretaceo-Tertiary have been respectively applied to New Zealand strata for obvious reasons. The former term has also been applied to Chilian strata by Darwin; and the latter, (but erroneously, I think,) to the Lara-

mie Group of our own country. Mr. Gardner would even extend the application of this latter term so as to embrace all that series of strata from the Dakota Cretaceous to the Laramie Group, inclusive. These terms, and the instances I have given of their application, are quite sufficient to show the existence of the facts to which I have called your attention. But the following instances of the early introduction and late continuance of certain important types are of especial interest in this connection.

From strata in Northwestern Punjab, India, which are by all geologists admitted to be of Carboniferous age, a remarkable collection of fossils was made which contained specimens of a species of Ammonites. Upon the announcement of this fact its truth was not only questioned by European paleontologists, but some went so far as to deny the possibility of the association of that genus with a Carboniferous fauna. Afterward the well-known paleontologist Waagen visited the locality and himself collected there specimens of *Ammonites*, *Ceratites*, and *Goniatites*, all associated together in the same layers with characteristic Carboniferous forms.

That *Goniatites* should be found in Carboniferous strata was to have been expected; but if the *Ceratites* and *Ammonites* had been found separately and unassociated with any other fossils, no European paleontologist would have hesitated to refer the one to the Triassic, and the other to the Cretaceous. In fact, Dr. Waagen has placed the Ammonite referred to under a generic group which is an especially characteristic one among Cretaceous faunas. This instance of the commingling of types which are characteristic of different periods is a remarkable one in all respects, and especially as showing the very early differentiation of even subgeneric forms, which are generally believed not to have existed until a much later period. Confirmatory of the fact of this introduction before the close of the Paleozoic age, of types which are especially characteristic of the Mesozoic, Professor Heilprin has announced the discovery of an Ammonitic form among a characteristic Carboniferous fauna from Texas.

The commingling in New Zealand strata of types which are usually found to characterize separate formations has already been referred to, but in this connection I also wish to mention the reported discovery in those islands of *Belemnites*, *Belemnitella*, and *Plesiosaurus* in strata which have usually been classed as Tertiary. There seems to be little reason to doubt that this is an instance of a natural transition from the Cretaceous to the Tertiary, so gradually accomplished that it cannot be said where the one ends and the other begins.

A similar survival of Mesozoic types into an epoch, the strata of which bear otherwise the fullest evidence of homotaxial relationship to the Eocene Tertiary, occurs in California. Here there is found a species of Ammonite associated with numerous genera which all paleontologists have agreed in regarding as characteristic of the Tertiary. The series of strata which contains this belated Ammonite is some ten thousand feet in thickness, the lower part of which is homotaxially related to the Cretaceous, and the upper part is similarly related to the Tertiary, with the exception just mentioned. Still, this series of strata has every appearance of having been produced by continuous sedimentation, and of presenting an intercommingling of Cretaceous and Tertiary types through the greater part, if not the whole, vertical range of the series.

In the cases which have just been mentioned, the continuation of ancient types among those of later origin, or of more modern characteristics, the comparison was made between the different members of one and the same fauna for the different portions of its existence; but in the case now to be considered, the comparison is to be made between continental faunas and floras. The case referred to is that of the Laramie Group. It will be remembered that in my address before this society last year I made some extended remarks upon this group, showing that it was deposited in a great inland sea of brackish and fresh waters. Comparison, therefore, is to be made between the aqueous fauna

of such a sea, and the land fauna and flora which existed upon its borders. I have upon several occasions called attention to the fact that brackish and fresh-water faunas have undergone far less differentiation during the lapse of geological epochs than marine faunas have. I cannot now contrast the aqueous fauna of the Laramie Group with any open-sea fauna, but, together with its contemporaneous flora and land molluscan fauna, it contrasts strangely with its contemporaneous land vertebrate fauna.

The aqueous fauna of the Laramie Group is mainly molluscan; and while the brackish-water forms show their relationship to the preceding Cretaceous marine fauna, the fresh-water and land mollusca are largely of types that now exist. The flora is also of a very modern character; but the vertebrate land fauna is largely Dinosaurian. I need not tell a paleontologist that here is a most remarkable mixture of types. The extraordinary biological character of this group will be still more conspicuously seen when I mention that I have collected the characteristic mollusca of this group where they were associated with Dinosaurian remains; and in the same series of layers I have also obtained numerous species of plants, several of which have by competent authority been identified with European Miocene species, and two of them with species now living in the United States. That is, we have evidence that a large molluscan fauna, and a luxuriant dicotyledonous flora, both containing species that we can with difficulty, if at all, distinguish from living forms, existed contemporaneously with great Dinosaurian reptiles such as have always been regarded as peculiar to the Mesozoic age.

The instances which I have presented demonstrate that in different parts of the world there are many and material departures from the European paleontological standard; but in no case have we seen that departure to be so great when marine formations are compared with each other as they are when formations containing a marine fauna are compared with those containing a continental fauna or flora. I therefore quite agree with those

who regard the marine faunas as much the most reliable indices of geological age.

During geological time the open sea has certainly afforded far greater uniformity of conditions for the existence and evolution of the different forms of life which it has contained than the land and fresh waters have done. Therefore, it is reasonable to conclude that, as a rule, the progress and ratio of the differentiation, evolution, and decadence among marine forms have been more uniform throughout geological time, and over greater areas, than has been the case with continental life. While, as we have seen, the ratio of evolution and decadence of marine types among themselves has not been so uniform as it has been assumed to have been by the European paleontological standard, such a ratio for the continental forms of life has often not only an extraordinary want of uniformity among themselves, but it is often at great variance with that of marine life.

Now it seems to me that the absence of a uniform ratio of evolution and decadence between marine, fresh-water, and land faunas and land floras, respectively, is just what we ought to expect when we consider the great variety of character of the various forms of life involved, and the great diversity of physical conditions under which they have existed. All that we yet know of ancient continental life points to the conclusion that the evolution of its various forms has been subject to frequent accelerations and retardations; and that, as a rule, they have been more subject to abrupt extinction than marine forms have. It is true, however, that some of the types among the continental faunas and floras which are now living have come down to us from very ancient times. It is also evident that a uniform rate of evolution of similar forms of continental life did not obtain in all parts of the world during the respective geological periods. An illustration of my meaning in this respect is afforded by our Cretaceous dicotyledonous flora already referred to. In America that flora had reached the European Tertiary stage long before the close of the Cretaceous period.

The instances which I have mentioned, besides many others which might be referred to, show that the confidence with which many paleontologists have decided upon the question of the synchronism of formations in widely separated portions of the earth, some of which are at most only one or two hundred feet in thickness, is quite unjustifiable.

I would gladly end here my arraignment of the unwarrantable positions which paleontologists have hitherto assumed, but I have yet to refer to others, especially to the custom of deciding upon the homotaxial relationship, or so-called equivalency, of formations upon insufficient evidence. Before the student of living animals and plants is prepared to decide in a satisfactory manner upon the forms which he is investigating, he requires not only a series of perfect specimens of his species, but also all that can be known of its anatomy and physiology, its habits and habitat, its associated forms, and its specific and generic relations. On the contrary, the paleontologist, as is well known, is confined to the study of such of the hard or skeletal parts of animals as may have escaped destruction by decomposition or other means; and the imprints or fragments of plants, mainly leaves.

One cannot cease to wonder at and admire the large amount of real knowledge which has been gained by the study of even such imperfect material as this. In fact, all that we know of the ancient life of the earth has been derived from this source; and by means of comparisons with related living forms we are often able, by the aid of a perfectly legitimate use of the imagination, to restore to a large extent the faunas and floras of long past geological periods. Encouraged by this success, and urged by the necessities of geology, paleontologists have assumed not only to decide upon the specific and generic identity of the forms represented by such imperfect material, but also to base upon it generalizations of the greatest importance in both geology and biology.

Every investigator knows how small a clue will sometimes lead to the unravelling of obscure problems in scientific research, and no one has more frequent occasion to give earnest attention to such clues than the working paleontologist. Indeed, some of his best results would often have escaped him if such clues had been disregarded. Such a use of even the most insignificant facts is perfectly legitimate; but I wish to refer especially to the practice which has prevailed of publishing what are ostensibly conclusions which have been reached from legitimate investigation, when in reality they are at best little more than mere surmises. I will give a couple of instances of this kind to illustrate my meaning.

In California and Western Nevada, where the country is mountainous and the rocks are much displaced and more or less altered, several isolated and limited exposures of strata have been found which contained a few fossil shells. At some of the localities half a dozen species are represented, but at some only one or two species. Most of these specimens are too imperfect to serve as the basis of even a satisfactory specific description; and none of the types presumably represented by them are of such a character as to give reasonable assurance of even homotaxial relationship with those of any European formation.

The most that can be said of this meagre fauna is that it is probably of Mesozoic age. And yet the equivalency of these rocks with the Jurassic of Europe has been confidently asserted, and broad generalizations have been based upon that assumption as to the age of mountain uplifts and other great geological events.

Again, there is in the western portion of the United States domain a formation which all geologists and paleontologists have agreed in referring to the Jurassic period. It is true that its invertebrate fauna is not full enough to afford entirely satisfactory evidence on this point, but the rich vertebrate fauna which

Professor Marsh has published from that formation has been accepted as conclusive. Furthermore, the position of the formation in relation to those which underlie and overlie it is confirmatory of the received opinion as to its Jurassic age. Notwithstanding this weight of evidence in the direction indicated, the paleontologist of the Canadian Geological Survey has, upon what I believe to be the mistaken identification of a comparatively small collection of imperfect and uncharacteristic fossil shells, referred the formation bodily to the Middle Cretaceous. When such a circumstance as this is possible it is certainly time we should examine well the grounds of our conclusions before we publish them to the world or base other results of our labors upon them.

While belief in the general applicability to all parts of the world of the chronological scale now in common use will probably never be seriously shaken, it is plain that we must abandon the idea that formations in widely separated parts of the world were necessarily synchronous in their origin because certain portions of their faunas or floras are similar. The custom has been to recognize a complete chronological scheme of the formations, of universal application, as already established, and to prosecute the geology of every part of the earth with the express view of making it conform to that scheme. But I submit that the geology of each of the large divisions of the earth ought to be studied independently, and untrammelled by preconceived notions of necessary conformity to a foreign standard. In my opinion, the time has not yet come for the construction of a complete and detailed chronological scale for the whole earth, and that it will not have fully arrived until the whole earth shall have been carefully studied.

If geology were studied in the different divisions of the earth with the ideas in view which I have indicated, its prosecution would be relieved of much useless labor, as well as freed from a

large proportion of the now prevailing liability to error. I do not wish to be understood as trying to discourage comparisons of the geology of different parts of the earth with each other. On the contrary, this ought constantly to be done; but what I wish to insist upon is that the study of each separate division of the earth should not be trammelled by a standard erected for another.

I have shown that the study of geology and paleontology has always been interdependent; but among certain geologists and paleontologists, respectively, there has been manifested a disposition to pursue the study of each branch separately, if not independently. A large part of the paleontological work which has been published has been done by men who have made no systematic study of field geology, or none in connection with their paleontological work. Much of their work has evidently been done in the belief that the paleontologist can sit in his study and fix with precision the geological horizons and the order of succession of the formations from which every collection submitted to him may come. If a difference of opinion in this respect has arisen between the field geologist and the paleontologist, each has contended for the truth of his own position, and each has often been shown to be in error.

It is therefore evident that the field geologist and paleontologist must work in concert. Indeed, the field geologist who ignores the use of fossils, as some have affected to do, is sure to burthen science with the results of worthless work; and the paleontologist who does not go to the field and study there the formations from which his fossils have been obtained is sure to produce results of work which will be worthy of the condemnation of both geologists and biologists.

But I am confident that there is a better day near at hand for the science to which so many able men have devoted their lives; and that the evils to which I have called your attention are already

passing away, and will soon be entirely of the past. When we remember what rapid strides have been made in all the branches of natural science within the memory of even the youngest workers, we have reason to anticipate a future for all those branches which will equal our most extravagant desires.

DESCRIPTION OF SOME NEW SPECIES OF BIRDS FROM COZUMEL ISLAND, YUCATAN.

By Robert Ridgway.

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A collection of birds made by Mr. J. E. Benedict, Naturalist of the U. S. Fish Commission Steamer "Albatross," assisted by Dr. T. H. Bean and Mr. Thomas Lee, on the Island of Cozumel, in January, 1885, contains the following new species. A full report upon the collection is in course of preparation and will soon be published in the Proceedings of the U. S. National Museum.

1. Harporhynchus guttatus, sp. nov.

Specific Characters.—Similar to *H. longirostris* (Lafr.), but smaller, darker in color, the bill wholly deep black, and all the markings more sharply defined. Type, No. 102,454, ♂, U. S. Nat. Mus.; Cozumel, Jan. 23.

2. Troglodytes beani, sp. nov.

Specific Characters.—Above plain brown, more castaneous on rump and tail, the latter indistinctly barred with darker, the remiges more distinctly barred. Lower parts, pure white; the sides, flanks, and crissum, light cinnamon-brown; the under tail-coverts barred or spotted with dusky. Wing, 2.20; tail, 1.90; culmen, .81; bill from nostril, .50; tarsus, .80; middle toe, .50. Type, No. 102,473, ♂, U. S. Nat. Mus.; Cozumel, Jan. 28.

3. Dendroica petechia rufivertex, subsp. nov.

Subspecific Characters.—Similar to *D. petechia ruficapilla* (Gmel.), of St. Thomas, and other Lesser Antilles, but with shorter wings and tail, and more intense coloration. Wing, 2.40; tail, 2.05. Type, No. 102,508, ♂, U. S. Nat. Mus.; Cozumel, Jan. 28.

4. Vireosylvia cinerea, sp. nov.

SPECIFIC CHARACTERS.—Agreeing with *V. magister* Baird, in absence of dusky sub-malar streak and streak on side of crown, but plumage ashy, instead of olive-brown. Wing, 3 00; tail, 2 30. Type, No. 105,656, U. S. Nat. Mus.; Cozumel, Jan. 29.

5. Vireo bairdi, sp. nov.

SPECIFIC CHARACTERS.—Above deep olive-brown, the wings with two broad bands of yellowish-white. Lores and median lower parts, pure white; the lateral lower parts, from cheeks to flanks, inclusive, deep cinnamon-ochre, in strong and abrupt contrast with the white. Type, No. 102,635, U. S. Nat. Mus.; Cozumel, Jan. 25.

6. Cyclorhis insularis, sp. nov.

SPECIFIC CHARACTERS.—Similar to *C. flaviventris* Lafr., but agreeing with *C. ochrocephala*, Tschudi, in coloration of the lower parts. Type, No. 102,659, ♀, U. S. Nat. Mus.; Cozumel, Jan. 28.

7. Spindalis benedicti, sp. nov.

SPECIFIC CHARACTERS.—Most like *S. zena* (Linn.), of the Bahamas, but much larger, the bill altogether heavier, the back and scapulars dark olive-brown instead of black, the lesser wing-coverts chestnut, and the yellow throat stripe entirely confluent with the chestnut of the jugulum. Wing (♂), 3.40; tail, 2.90. Type No. 102,675, ♂, U. S. Nat. Mus.; Cozumel, Jan. 29.

8. Euetheia olivacea intermedia, subsp. nov.

SUBSPECIFIC CHARACTERS.—Intermediate between and connecting *E. olivacea* (Gm.) and *E. olivacea pusilla* (Sw.), having the grayer cheeks of the former and greater extension of black on the breast of the latter. Type, No. 102,710, ♂, U. S. Nat. Mus.; Cozumel, Jan. 28.

9. Centurus leei, sp. nov.

SPECIFIC CHARACTERS.—Similar to *C. dubius* (Cabot), but lower rump and upper tail-coverts barred with black, and lower parts darker. Type, No. 102,777, U. S. Nat. Mus.; Cozumel, Jan. 28.

10. Attila cozumelæ, sp. nov.

SPECIFIC CHARACTERS.—Most like *A. citreopygia* (Bonap.), but lower parts grayish white, the throat and jugulum very indistinctly streaked with darker. Type, No. 102,767, U. S. Nat. Mus.; Cozumel, Jan. 29.

11. Lampornis thalassinus, sp. nov.

SPECIFIC CHARACTERS.—Most like *L. prevosti* (Less.), but upper parts less bronzy or more of a grass-green, the black on the throat much more extended, and the breast greenish-blue. Type, No. 102,796, ♂, U. S. Nat. Mus.; Cozumel, Jan. 24.

12. Chlorostilbon forficatus, sp. nov.

SPECIFIC CHARACTERS.—Most like *C. caniveti* (Less.), but tail much longer (1.90 inches, forked for 1.15). Type, No. 102,812, ♂, U. S. Nat. Mus.; Cozumel, Jan. 23.

13. Empidonax gracilis, sp. nov.

SPECIFIC CHARACTERS.—Above ash-gray, more brownish, but still decidedly gray, on lower back, rump, and upper tail-coverts; a distinct orbital ring, two broad wing-bands, and broad edges to tertials, grayish-white; sides of head, light ash-gray, fading to grayish-white on throat; jugulum and sides of breast, light brownish-gray; rest of lower parts, white. Wing, 2.50; tail, 2.20; culmen, .55; bill, from nostril, .25; width of bill at base, .23; tarsus, .60; middle toe, .30. Type, No. 102,737, ♀ (?), U. S. Nat. Mus; Cozumel, Jan. 22.

14. Myiarchus platyrhynchus, sp. nov.

SPECIFIC CHARACTERS.—Above dull brown, without olive tinge, darker on pileum; upper tail-coverts and edges of rectrices, remiges, and greater wing-coverts, rusty. Chin, throat, and jugulum, pale ash-gray; rest of lower parts, very pale sulphur yellow. Wing, 3.00; tail, 2.00; culmen, .85; bill, from nostril, .50; width at base, .33; tarsus, .80; middle toe, .42. Type, No. 102,738, ♀ (?), U. S. Nat. Mus.; Cozumel, Jan. 22.

15. Cardinalis saturatus, sp. nov.

SPECIFIC CHARACTERS.—Similar to *C. virginianus coccineus*. Ridgw., but still more deeply colored, the bill shorter and relatively much thicker. Female, with the capistrum dark slaty and very conspicuous. Type, No. 102,720, ♂, U .S. Nat. Mus.; Cozumel, Jan. 24.

DESCRIPTION OF A NEW SPECIES OF CHIPMUNK FROM CALIFORNIA (*Tamias macrorhabdotes* sp. nov.).

By Dr. C. Hart Merriam.

(Read December 26, 1885.)

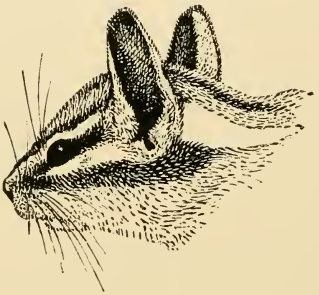
I have recently secured, from the Sierra Nevada mountains of central California, a series of Chipmunks or Ground Squirrels which differ markedly from any known species. In size they closely approach typical examples of *Tamias asiaticus townsendi;* and in coloration they are in some respects intermediate between vars. *townsendi* and *borealis*, while in other respects they are peculiar. They may be distinguished at a glance from all other described forms by the great length of the ear, the clearness and sharpness of definition of the light stripe which occupies its posterior half, and by the large size and whiteness of the spot behind its base.

Tamias macrorhabdotes* sp. nov. **LONG-EARED CHIPMUNK.**

Diagnosis.—Ears exceedingly long, measuring from 16 to 17 mm. in height from the occiput (average of ten, 16.20 mm.). Crown grizzled grayish-brown, more or less mixed with rusty; convex surface of ears sharply bicolor vertically, anterior half sooty-brown, with a slight admixture of rusty near the anterior margin, posterior half ashy-white in striking contrast; a large white spot (nearly as large as the ear itself) on each side of the neck just behind the ear and continuous with its ashy-white posterior half and with the white cheek-stripe under the eye, and almost continuous posteriorly with the external lateral white

*Macro-rhabd-ótes: μακρός, long; ῥάβδος, stripe; οὖς, ὠτός, ear,—in allusion to the long, striped ear, which is diagnostic of the species.

stripe; five dark dorsal stripes (outer often indistinct), rusty umber to sepia brown; the two outer of each side separated by a grayish-white stripe which is almost continuous anteriorly with the white blotch behind the ear; the median and inner of each side separated by a grayish stripe more or less obscured with rusty; rump grizzled gray sometimes tinged with brownish; sides pale fulvous to deep rusty fulvous, the color extending well



TAMIAS MACRORHABDOTES.

up on the neck, but never back over the hips; under parts white or soiled white; tail above sub-terete, almost black, with hoary tips to the hairs and with more or less hazel showing through; tail below distichous, mesially bright hazel, heavily bordered with black and edged with hoary. The facial stripes are highly developed and are five in number, three rusty umber and two white, as follows: A narrow white stripe runs from the tip of the nose to the anterior base of the ear, passing over the eye; it is bordered above by a stripe of rusty umber (which is broadest and darkest from the eye to the ear), and below by another of the same color which passes through the eye and terminates at the meatus; below this is a second white stripe, broader than the first, which runs just below the eye and thence backward under the root of the ear, where it bends upward and backward, becom-

ing continuous with the white spot behind the ear; below this still is another rusty umber stripe which ends against the white just back of the ear.

Measurements.—The twelve specimens before me are all skins, but they are well prepared and afford measurements which may be regarded as approximately correct. The length of head and body varies from 125 to 140 mm. and the tail with hairs from 105 to 130 mm. The hind foot with claw averages between 34 and 35 mm.

Cranial Characters.—The nasal bones are both relatively and absolutely longer in *macrorhabdotes* than in its nearest ally, *townsendi*, notwithstanding the fact that the latter is the larger animal. The longest nasal in the four skulls of *townsendi* before me measures 11.00 mm., while the smallest of five adult *macrorhabdotes* measures 12.60 mm. and the largest 13.20 mm. The nasals usually project backward in *macrorhabdotes* beyond the line of the fronto-premaxillary suture, while in *townsendi* they generally end flush with the suture. Their ratio to the basilar length in *townsendi* is 35.73 mm. (average of two), against 44.54 in *macrorhabdotes* (average of five fairly adult specimens). In addition to their shortness, the nasal bones in *townsendi* average a little broader, particularly behind; thus the average width (at the fronto-premaxillary suture) of four specimens of *townsendi* is 3.27 mm., while the average of eight specimens of *macrorhabdotes* is 2.85 mm. Hence the average of the ratios of the posterior breadth of the nasal bones to their length in nine skulls of *macrorhabdotes* is 22.97, while in four skulls of *townsendi* it is 30.75.

Interorbitally, the frontal bone averages somewhat broader in *macrorhabdotes* than in *townsendi*. The palate is longer in the latter. The average ratio of the length of the palate to the basilar length in eight specimens of *macrorhabdotes* is 53.96, while in two specimens of *townsendi* it is 56.80.

The parietal and supra-occipital bones co-ossify so early in life that in the adults it is generally impossible to detect the suture between them; hence they are here measured together. They are very much shorter in *macrorhabdotes* than in *townsendi*, measuring from 10.60 to 11.00 mm. (four-tenths of a millimetre covering the limits of variation in nine specimens); while in *townsendi* two specimens measure respectively 13.50 and 13.00 mm. The average of the ratios of the length of the parietals and supra-occipital, thus united, to the basilar length in eight skulls of *macrorhabdotes* is 37.87; in two of *townsendi* it is 45.77.

The first upper premolar is decidedly smaller in *macrorhabdotes* than in *townsendi;* it has evidently ceased to be functional and is fast becoming obsolete—one of many characters pointing to the higher differentiation of the new species.

The pretty little Striped Squirrel which forms the subject of the present paper is one of peculiar interest. It is surprising that an animal of its size and diurnal habits, and one which differs so markedly from even its nearest relative, should have escaped so long the notice of the many naturalists and collectors who have traversed the region. The most natural explanation is that the Long-Eared Chipmunk is an exceedingly local species, restricted in its range by certain physiographical conditions of which we are at present ignorant—conditions which were influential, doubtless, in bringing about the modifications which distinguish it from its congeners and mark it as one of the most highly specialized of the genus *Tamias*. That this genus is peculiarly susceptible to environmental influences is amply attested by the number and perplexing characteristics of the incipient species already known from the United States.

The specimens of this new species were collected by C. A. Allen, of Nicasio, California, and the accompanying figure was drawn by Ernest E. T. Seton.

ON A NEW METHOD OF PRODUCING IMMUNITY FROM CONTAGIOUS DISEASES.

By D. E. Salmon, D. V. M., and Theobald Smith, M. D.

(Read February 20, 1886.)

More than four years ago * one of us, in the study of the subject of insusceptibility to contagious diseases, reached the conclusion that, in those diseases in which one attack protects from the effects of the contagion in the future, the germs of such maladies were only able to multiply in the body of the individual attacked because of a poisonous principle or substance which was produced during the multiplication of those germs. And also that, after being exposed for a certain time to the influence of this poison, the animal bioplasm was no longer sufficiently affected by it to produce that profound depression and modification of the vital activity which alone allowed the growth of the pathogenic germs and the consequent development of the processes of disease. After several series of experiments, made at that time with only negative results, it became necessary to suspend these investigations until points connected with them, and which were then obscure, should be cleared up, and until it should become possible to repeat the experiments under more favorable conditions. Our expectations in regard to this important subject have at last been realized by the results of experiments recently made in the laboratory of the Bureau of Animal Industry.

The bacterium, which we have lately discovered and which we believe to be the cause of swine plague, is killed in liquid cultures by an exposure to 58° C. for about ten minutes.

This method of destroying the bacterium in liquid cultures was resorted to in studying the effects on pigeons of the chemical

* Department of Agriculture, Annual Report, 1881–2, pp. 290–295.

products (ptomaines?) formed by the bacteria in their vegetative state, and which are probably dissolved in the culture liquid. The heated cultures used in these experiments were always tested by inoculating fresh tubes therefrom, and, if no growth followed this inoculation, the death of the microbes was considered established.

It had been previously determined that the subcutaneous injection of .75 cc. ($\frac{3}{1}\frac{}{6}$ dram) of a liquid culture of the swine plague bacterium containing 1% of peptone was invariably fatal. in the majority of pigeons within 24 hours. One half of this dose was fatal to a few only.

As a preliminary experiment, four pigeons were inoculated December 24, 1885, with a liquid culture that had been heated for 2 hours at 58°–60° C. Three of these (Nos. 10, 8, 9) received subcutaneously .4, .8, and 1.5 cc. of the heated culture, respectively. The fourth (No. 7) received 1.5 cc. of the pure culture liquid, into which no microbes had been introduced. No. 9, the one which had received the largest dose, was evidently sick the next day, but slowly recovered. The others did not show any symptoms of illness.

January 11, the one which had received a hypodermic injection of the simple culture liquid (No. 7), and the one which had received the largest dose of heated virus (No. 9), received subcutaneously about .75 cc. each of a liquid culture five days old, which had been prepared from a potato culture 15 days old. It is probable that this virus was not so strong, therefore, as a more recent culture from the pig would have been. Both pigeons were sick on the following day. No. 7 died seven days after inoculation. The bacterium of swine plague was found abundantly in the pectoral muscle, in the spleen, kidneys, and liver in moderate numbers.* The other pigeon (No. 9) slowly recovered, but had

*In this animal the major part of both pectoral muscles appeared as if they had been boiled; they were whitish, bloodless; the fibres could be easily broken and crushed with the forceps. The muscular tissue surrounding the dead portion was very dark, gorged with blood. The liver was dark in patches; spleen and kidney pale.

lost the use of its legs. It seemed perfectly well when killed, 15 days after inoculation. It was quite fat, the crop filled with food. In the pectorals were found imbedded two elongated masses of dead tissue or sequestra about 2 cm. long and 1 cm. in diameter, entirely separated from the surrounding tissue by a dense, smooth membrane. In this animal the multiplication of the pathogenic bacteria was purely local, the resistance of the tissues being sufficiently powerful to confine, and finally destroy, the bacteria. The sequestra were made up of dead muscular fibre, which was pale and parboiled in appearance. Each was enveloped by a more or less hyaline homogeneous layer. A liquid culture, inoculated with blood from the heart, remained sterile.

This experiment pointed evidently to an immunity obtained from the chemical products of the bacterium of swine plague. To confirm this view another experiment was made.

January 21, three pigeons (Nos. 11, 12, 13) received hypodermically 1.5 cc. of heated culture liquid in which the bacterium of swine plague had multiplied for two weeks, and was then destroyed by exposure to 58°–60° C. for several hours. A fourth pigeon (No. 14) was kept as a check. No. 10, which had received .4 cc. of heated virus Dec. 24, now received a second dose, this time of 1.5 cc. For the following three or four days all were somewhat ill, and remained rather quiet, with feathers slightly ruffled.

January 29, when all seemed well, three of the four (Nos. 10, 11, and 12) received hypodermically another dose of 1.5 cc. of heated culture liquid. The other (No. 13) had been fiercely attacked by its fellows, and its head was so injured that it was thought best not to give it an injection at this time, and it was placed in a spacious coop alone. None of the birds seemed much affected by this dose.

February 6, a final injection was practised upon the four, No. 13 having recovered from the effects of its injuries. The dose was, as before, 1.5 cc. All seemed well a few days later.

February 13, one week after the last injection, these birds were inoculated with strong virus, the quantity injected being .75 cc., which had hitherto proved invariably fatal, with the single exception of the bird that had been previously treated with heated virus. Those inoculated were Nos. 10, 11, 12, 13, which had received the heated virus, also No. 14, the check pigeon, which had not been touched, and No. 8, which had received a small quantity, .8 cc. of heated virus, December 24, over 50 days before.

On the following day the check pigeon (No. 14) was found dead; the one which had received the smaller dose (No. 8) was very ill and died before the next day. The other pigeons were perfectly well. The effect of this dose of strong virus, so remarkable on the unprotected pigeons, was even more evanescent than that of the heated virus in which all life had been destroyed.

There can be no doubt, therefore, from this very positive result, that the pigeons had acquired an immunity through the effect upon the tissues of the chemical products formed by the bacterium in the culture liquid.

A table giving the dates of the injections and the quantity introduced into each animal is given below:

Pigeons.	1885.	1886.				Total of Heated Virus.	Remarks.
	Dec. 24.	Jan. 21.	Jan. 29.	Feb. 6.	Feb. 13.		
	Heated Virus.	Heated Virus.	Heated Virus.	Heated Virus.	Strong Virus.		
	cc.	cc.	cc.	cc.	cc.	cc.	
No. 8.....	.8	.....	.....	.....	.75	.8	Died in 48 hours after injection of strong virus.
" 10.....	.4	1.5	1.5	1.5	.75	4.9	Well Feb. 20.
" 11.....	.....	1.5	1.5	1.5	.75	4.5	Same.
" 12.....	.....	1.5	1.5	1.5	.75	4.5	Same.
" 13.....	.....	1.5	.....	1.5	.75	3.0	Same.
" 14.....	.....	.....	.....	.....	.75	.....	Died in 24 hours after injection of strong virus.

In the birds that died, (Nos. 8 and 14), the pectoral muscles at the place of injection were pale and friable. Necrosis was

already at hand. The internal organs were not macroscopically altered, excepting the spleen of No. 8, which was enlarged and dark. The presence of the bacterium of swine plague in the blood from the heart was demonstrated by liquid cultures, which, inoculated with a minimum quantity of blood, were turbid with this specific microbe on the following day.

The conclusions to be drawn from this experiment we believe are of superlative importance to a correct understanding of the phenomena of contagious diseases, and the methods by which these diseases are to be combated. They probably apply to all bacterial plagues of men and animals in which one attack confers immunity from the effects of that particular virus in the future. These conclusions are:

1. Immunity is the result of the exposure of the bioplasm of the animal body to the chemical products of the growth of the specific microbes which constitute the virus of contagious fevers.

2. These particular chemical products are produced by the growth of the microbes in suitable culture liquids in the laboratory, as well as in the liquids and tissues of the body.

3. Immunity may be produced by introducing into the animal body such chemical products that have been produced in the laboratory.

THE BEGINNINGS OF NATURAL HISTORY IN AMERICA.*

By G. Brown Goode.

> Is not Science a growth? Has not Science its embryology? And must not a neglect of its embryology lead to a misunderstanding of the principles of its evolution and of its existing organization?
>
> —Spencer: *The Genesis of Science.*

ANALYSIS.

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I.

Three centuries ago the only English settlement in America was the little colony of one hundred and eight men which Raleigh had planted, five months before, upon Roanoke Island, in North Carolina.

The 17th of August, 1885, was the anniversary of one of the most noteworthy events in the history of America, for it marked the three hundredth return of the date when Sir Richard Gren-

* Annual presidential address delivered at the Sixth Anniversary Meeting of the Society, February 6, 1886, in the Lecture Room of the U. S. National Museum.

ville brought to its shores this sturdy company of pioneers, who, by their sojourn on this side of the Atlantic, prepared the way for the great armies of immigrants who were to follow.

It was also the anniversary of an important event in the history of science, for among the colonists was THOMAS HARRIOTT —the first English man of science who crossed the Atlantic. His name is familiar to few, save those who love the time-browned pages and quaint narrations of Hakluyt, Purchas, and Pinkerton; yet Harriott was foremost among the scholars of his time—the Huxley or the Stokes of his day—a man of wide culture, a skillful astronomer, a profound mathematician, the author of a standard treatise upon algebra, and a botanist, zoologist, and anthropologist withal. "He had been the mathematical instructor of Raleigh, and in obeying this summons to go forth upon the present expedition, gave to it," says Anderson, "the most valuable aid which could be derived from human strength."*

This eminent man deserves more than a passing notice on this occasion, and I have taken pains to bring together all that is known about him. He was born at Oxford in 1560, or as old Anthony Wood quaintly expresses it, "he tumbled out of his mother's womb into the lap of the Oxonian muses," and, at an early age, was entered as a scholar in St. Mary's Hall, receiving his bachelor's degree in 1579. He was soon received into Raleigh's family as his instructor in mathematics, and, at the age of twenty-five, made his voyage to America.

After his return he was introduced by Raleigh to Henry Percy, Earl of Northumberland, one of the most munificent patrons of science of that day, who allowed him a pension of £120 a year. "About the same time," we are told, "Hues, well known by his 'Treatise upon the Globes,'† and Walter Warner, who is said to have given Harvey the first hint concerning the circulation of the blood, being both of them mathematicians, received

* ANDERSON: *History of the Church of England in the Colonies*, p. 86.
† *Tractatus de Globis*, etc., 1611.

from him (Northumberland) pensions of less value; so that in 1606, when the Earl was committed to the Tower for life, Harriott, Hues, and Warner were his constant companions, and were usually called the Earl of Northumberland's Magi."*

One thing, at least, have three centuries accomplished for science. Its greatest workers are not now, as they were at the beginning of the seventeenth century, dependent upon the liberality and caprice of wealthy men, classed as their "pensioners" and "servants," and assigned places at their tables which they must needs accept or famish.

Harriott appears to have passed the latter years of his life at Sion College, in Oxford, where he died in 1621. He was buried in St. Christopher's Church, and the following eulogy was embodied in his epitaph:

QUI OMNES SCIENTIAS CALLUIT AC IN OMNIBUS EXCELLUIT
MATHEMATICIS, PHILOSOPHICIS, THEOLOGICIS.
VERITATIS, INDAGATOR STUDIOSISSIMUS,
DEI TRINIUNIUS PIISSIMUS.

He was especially eminent in the field of Mathematics. "Harriott," says Hallam, "was destined to make the last great discovery in the pure science of algebra. * * * Harriott arrived at a complete theory of the genesis of equations, which Cardan and Vieta had but partially conceived."†

His improvements in algebra were adopted, we are told, by Descartes, and for a considerable time imposed upon the French as his own invention, but the theft was at last detected and ex-

* Harriott was also a friend and companion of Raleigh during his imprisonment in the Tower (1603–16), and was his collaborator in the preparation of the "History of the World." His fidelity was rewarded by that distinguished authority, Chief-Justice Popham, who denounced him from the bench as "a devil."

† HALLAM: *Introduction to the Literature of Europe*, 4th ed., 1854; i, pp. 454, 456; ii, p. 223; iii, p. 181. See also MONTUCLA: *Histoire des Mathematiques*, and ERSCH AND GRUBER: *Algemeine Encyklopædie*.

posed by Dr. Wallis in his "Treatise of Algebra, both Theoretical and Practical," London, 1685.*

"Oldys, in his Life of Sir Walter Raleigh, has shown," says Stith, "that the famous French philosopher, Descartes, borrowed much of his light from this excellent mathematician, and that the learned Dr. Wallis gave the preference to Harriot's improvements before Descartes', altho' he had the advantage of coming after and being assisted by him." †

Harriott's papers were left after his death in the possession of the Percy family at "Petworth," where they were examined in 1787 by Dr. Zach, and later by Prof. Rigaud, of Oxford, who, in 1833, published in his supplement to the works of James Bradley, "An Account of Thomas Harriot's Astronomical Papers." His observations on Halley's comet in 1607 are still referred to as being of great importance. Zach pronounced him an eminent astronomer, both theoretical and practical. "He was the first observer of the solar spots, on which he made a hundred and ninety-nine observations; he also made many excellent observations on the satellites of Jupiter, and indeed, it is probable that he discovered them as early if not earlier than Galileo." ‡

A posthumous work, "Artes Analyticæ Praxis ad Æquationes algebraicas nova, expedita et generali Methodo resolvendas, e posthumis Thomas Harriot," was published in 1631 by his friend and associate, Walter Warner, and there is in the library of Sion College a manuscript work of his entitled "Ephemeris Chyrometrica."

Wood says that, "notwithstanding his great skill in mathematics, he had strange thoughts of the scriptures, always under-

* It would appear, however, that Wallis may have been too enthusiastic in his admiration of the English mathematician. Hallam states that he ascribed to Harriott a long list of discoveries which have since been reclaimed for Cardan and Vieta.

† Stith: *History of Virginia*, 1747, p. 20.

‡ Good and Gregory: *Pantologia*, vol. v.

valued the old story of the creation of the world, and would never believe that trite proposition, 'Ex nihilo nihil fit.'"

Stith, the historian of Virginia, protests, however, against the charge that Harriott had led his pupil Raleigh into atheism. "As to this groundless Aspersion," he remarked, "the Truth of it, perhaps, was that Sir Walter and Mr. Harriott were the first who ventured to depart from the beaten Tract of the Schools, and to throw off and combat some hoary Follies and traditionary Errors which had been riveted by age, and rendered sacred and inviolable in the eyes of weak and prejudiced Persons. Sir Walter is said to have been first led to this by the manifest Detection, from his own Experience, of their erroneous Opinions concerning the Torrid Zone, and he intended to have proceeded farther in the Search after more Solid and important Truths 'till he was chid and restrained by the Queen, into whom some Persons had infused a Notion that such Doctrine was against God."*

The erroneous opinions concerning the torrid zone which were called in question by Harriott and Raleigh were based upon a statement of Aristotle, in those days accepted as an article of faith, that the equatorial zone of the earth was so scorched and dried by the sun's heat as to be uninhabitable. Even the experience of explorers was for many years overpowered by the weight of this time-worn dogma. The Jesuit, Acosta, was accused of atheism on the same grounds, by his Spanish contemporaries, but he rejoiced that he had seen for himself, and that the climate under the equator was so different from what he had expected that "he could but laugh at Aristotle's meteors and his philosophy."

Harriott's "Brief and True Report of the New Found Land of Virginia," a thin volume in quarto, printed at Frankfort-on-the-Main in 1590,† is now one of the rarest and most precious

* STITH: *History of Virginia*, p 20.

† 1590. HARIOT (or Harriott), THOMAS. A briefe and true report | of the new found land of Virginia | of the commodities and of the nature and man | ners of the naturall inhabitants. Discouered by the English Col-

works relating to America,* and is full of interest to the naturalist. Harriott's description of the Indians and their customs and beliefs, though strongly tinctured with prepossessed ideas concerning them, is thorough and scholarly, and one of the fullest and most reliable of the early treatises upon the inhabitants of North America.

The chief man of the Roanoke colony, Sir Ralph Lane, usually spoken of as the first governor of Virginia, was a man of great energy and enterprise,† and with the help of Harriott planned and conducted expeditions in every direction; southward eighty leagues to Secotan, "an Indian town lying between the rivers Pampticoe and Neus," to the northwest up the Albemarle Sound and Chowan River, to the forks of the Meherrin and Nottaway; and north one hundred and thirty miles to the Elizabeth River, on the south side of Chesapeake Bay.

Besides his description of the Indians, Harriott wrote "a particular narrative of all the beasts, birds, fishes, fowls, fruits, and roots, and how they may be useful." A systematic report could hardly

ony there seated by Sir Richard | Greinuile Knight In the yeere 1585. Which rema | ined Vnder the gouernment of twelue monethes, | At the special charge and direction of the Honou- | rable SIR WALTER RALEIGH Knight lord Warden | of the stanneries Who therein hath beene fauoured | and authorised by her MAIESTIE | : and her letters patents: | This fore booke Is made in English | By Thomas Hariot, seruant to the above named | Sir WALTER, a member of the Colony and there | imployed in discouering | CUM GRATIA ET PRIVILEGIO CAES. MAtis SPECIALI | Francoforti ad Mœnum | Typis Ioannis Wecheli, sumtibus vero Theodori | DeBry Anno CIↃ IC XC, | venales reperuunter in officina Sigismundi Feirabendii. | 4°. pp. 1–33 (1). *Title page with ornamental border of architectural design.*

* There are now only six or seven perfect copies in existence. These, we are told by Sabine, are in the British Museum and Bodleian libraries, and in the private collections of Messrs. Lennox, Brown, Christie-Miller, and Mann, besides an imperfect copy in the library of Harvard College and one in the possession of Sir Thomas Phillipps. At a sale in London in 1883 a copy sold for 300 pounds. A reproduction in photo-lithographic fac-simile was issued by Sabine in New York in 1875.

† See Life of Sir Ralph Lane, by Edward Everett Hale. *Archæologia Americana*, iv, pp. 317–347.

be expected from one who lived a century and a half before Linnæus, but if we keep in mind the condition of zoology at that day we can but be pleased with the fullness of his narrative.

He collected the names of twenty-eight species of mammals, twelve of these, including the black bear, the gray squirrel, the cony or hare, the otter, and the possum and raccoon, (*Saquenúckot* and *Maquówoc*), he saw, beside the civet cat or skunk, which he observed by means of another sense. He was the first to distinguish the American from the European deer, stating that the former have longer tails, and the snags of their horns look backward—a brief diagnosis, but one which was not replaced by a better one for nearly two centuries.

Of birds he collected the names of eighty-six "in the countrie language," and had pictures drawn of twenty-five. He mentions turkeys, stockdoves, partridges, crows, herons, and in winter, great store of swans and geese.

With aquatic animals he seems to have been well acquainted. He refers to some by English names, and to many others which had no names "but in the countrey language." In the plates accompanying the first edition of his book are figured several familiar forms, then for the first time made known in Europe, among them the gar pike (*Lepidosteus*),* and the horse shoe or king crab (*Limulus*),† "*Seekanauk*, a kinde of crustie shell fishe which is good meate, about a foot in breadth, having a crustie tayle, many legges like a crabbe, and her eyes in her back."

* Subsequently referred to by Champlain in 1613, and Sagard in 1636, under the name *chaousarou*, and figured by Champlain on his map of *Nouvelle France*. Creuxin in his *History of Canada*, 1664, also mentions it.

† It has been generally supposed that Champlain was the first to notice this characteristic American animal, and Slafter, in his notes upon Champlain's works, [*Publications of the Prince Society, Champlain's Voyages*, vol. ii, p 87,] makes a statement to that effect, and is followed by Higginson in his History of the United States. Actually, the French explorer did not observe it until twenty years after Harriott, and his account of it was not printed until 1613.

Harriott also alludes to various kinds of trees and shrubs, usually by their Indian names. Among them may easily be recognized the pitch-pine, sassafras, shoemake, chestnut, walnut, hickory, persimmon, prickly pear, Nelumbium, Liriodendron, holly, beech, ash, and so on, beside the maize and tobacco cultivated by the natives.

A companion of Harriott's, whose labors are deserving of notice, was John With or White, the first delineator of plants and animals who visited this continent. Concerning him and the ultimate utilization of his work, Stith discourses as follows:

UPON this Voyage, Sir *Walter Ralegh*, by the Queen's Advice and Directions, sent, at no small Expence, Mr. John With, a skilful and ingenious Painter, to take the Situation of the Country, and to paint, from the Life, the Figures and Habits of the Natives, their Way of Living, and their several Fashions, Modes and Superstitions, which he did with great Beauty and Exactness. There was one *Theodore De Bry*, who afterwards published the beautiful *Latin* Edition of Voyages in six Volumes, *Folio*, a most curious and valuable Work. He being in England, soon after, by the Means of the Rev. Mr. *Richard Hackluyt*, then of *Christ's-Church*, in Oxford, obtained from Mr. *With* a Sight of these Pieces, with Permission to take them off in Copper Plates. These, being very lively and well done, he carried to *Frankfort* on the *Maine*, where he published a noble Edition of them, with Latin Explanations, out of *John Wechelius's* Press, in the Year 1590. And there are the Originals from which Mr. *Beverley's* and the Cuts of many of our late Writers and Travellers have been chiefly imitated.*

With's drawings are still in the British Museum,† where they were examined in 1860 by Dr. E. E. Hale, who reported upon their condition to the American Antiquarian Society.‡

This collection, he says, consists of 112 drawings in water-color, very carefully preserved. They are very well drawn, colored with skill, and even in the present state of art would be considered anywhere valuable and creditable representations of

* STITH: *History of Virginia*, p. 16.
† Sloane & Additional MSS., 5270.
‡ See *Archæologia Americana*, iv, pp. 21–24.

the plants, birds, beasts, and men of a new country. Mr. Hale gives a list of these drawings as identified by Sloane and others. Among these were the bald eagle, the red-headed, hairy, and golden-winged woodpeckers, the bluebird, red-wing blackbird, towhee, red-bird, blue jay, and fox-colored thrush, the crow blackbird, and apparently the mocking bird—"*Artamockes*, the linguist; a bird that imitateth and useth the sounds and tones of almost all birds in the Countrie." Among the fish we recognize the mullet (*Tetszo*), the menhaden or old-wife (*Masunnehockeo*), and the sturgeon (*Coppauleo*), and perhaps the squeteague or chigwit (*Chigwusso*).

The science of North America, then, began with Thomas Harriott. Let us review together to-night its progress for a period of two centuries—a period coinciding almost exactly with the colonial portion of the history of the United States.

"The present generation," says Whewell, "finds itself the heir of a vast patrimony of science, and it must needs concern us to know the steps by which these possessions were acquired and the documents by which they are secured to us and our heirs forever. Our species from the time of its creation has been travelling onwards in pursuit of truth; and now that we have reached a lofty and commanding position, with the broad light of day around us, it must be grateful to look back on the line of our past progress; to review the journey begun in early twilight amid primeval wilds; for a long time continued with slow advance and obscure prospects; and gradually and in later days followed along more open and lightsome paths, in a wide and fertile region. The historian of science, from early periods to the present time, may hope for favor on the score of the mere subject of his narrative, and in virtue of the curiosity which the men of the present day may naturally feel respecting the events and persons of his story."

II.

Although Harriott was the first who described the natural characteristics of North America, it would not be proper to ignore the fact that the first scientific exploration of the western continent was accomplished by Spaniards and Frenchmen.

Gonzalo Fernandez de Oviedo y Valdes, the first historian of the New World, [b. 1478, d. 1557], was an Asturian of noble birth, who began life as a page in the palace of Ferdinand and Isabella. He saw Columbus at Burgos on his second return from America in 1496. He came over in 1514 to Santo Domingo, having been appointed inspector of gold-smelting, and was subsequently governor of that island and royal historiographer of the Indies. In 1525 he transmitted to Charles V. his "Sumario de la Natural Historia de las Indias," printed at Toledo two years later, and in 1535 began the publication of his "Historia General y Natural de las Indias," a task which was finally completed only thirty years ago by the Spanish Royal Academy of History.

Las Casas said that Oviedo's books were "as full of lies almost as pages," but whatever may have been his methods in the discussion of history and politics, he seems, in his descriptions, to have been both minute and accurate. Among the American animals which he was first to mention was the tapir or *dant*—"of the bignesse of a meane mule, without hornes, ash-coloured," and the *churchia*, evidently a species of *Didelphys*, allied to our possum. This was the first notice of any member of the great group of marsupial mammals. I quote a portion of the description in Oviedo's "Sumario," employing the quaint phraseology of Purchas's translation:

"The *Churchia* is as bigge as a small *Conie*, tawnie, sharpe-snowted, dog-toothed, long-tayled and eared like a *Rat*. They do great harm to Hennes, killing sometimes twenty or more at once to sucke their bloude: And if they then have young shee carrieth them with her in a bagge of skin under her belly, run-

ning alongst the same like a Satchell, which shee opens and shuts at pleasure to let them in and out."*

He characterized and described at length many other animals, among them the manatee, the iguana (*Iuanna*), the armadillos (*Bardati*), the ant-eaters, the sloth, the pelican, the ivory-billed woodpecker, and the humming birds.

"There are found in the foune land," he wrote, "certaine birds, so little that the whole body of one of them is no bigger than the top of the biggest finger of a man's hand, and yet is the bare body, without the feathers, not half so bigge. This Bird, besides her littlenesse, is of such velocitie and swiftness in flying that who so seeth her flying in the aire cannot see her flap or beat her wings after any other sort than doe the Humble Bees or Beetles. And I know not whereunto I may better liken them then to the little birds which the lymners of books are accustomed to paint on the Margent of Church Bookes and other Bookes of Divine Service. Their feathers are of manie faire colours, golden, yellow and greene."

That the spirit of Oviedo's work was scientific and critical, and not credulous and marvel-seeking, like that of many of his contemporaries, is everywhere manifest. His materials are classified in systematically arranged chapters. His methods may be illustrated by referring to his chapter "On Tigers."

"In Terra Firma," he begins, "are found many terrible beasts which the first Spaniards called tigers—which thing, nevertheless, I dare not affirm." He then reviews concisely and critically what is known of tigers elsewhere, and goes on to describe the supposed American tiger at length, and in such terms that it is at once evident that the mammal under discussion is one of the spotted cats, doubtless the jaguar (*Felis onca*).†

The second in order of time to publish a book upon American natural history was Jean de Lery, [b. 1535, d. 1611], a Calvinistic minister, who was a member of the Huguenot colony founded by the Chevalier de Villegagnon in 1555, on the small island

* *Sumario*, Cap. xxvii. PURCHAS: *his pilgrimes*, iii, p. 995.
† *Sumario*, Cap. xi.

in the bay of Rio de Janeiro, which still bears his name. He remained in Brazil less than five years, and in 1578 published at Rouen a work entitled "Voyage en Amerique, avec la description des Animaux et Plantes de ce Pays."

José d' Acosta was another Spanish explorer who preceded Harriott, and was a man of much the same school and temper of mind. Born in the province of Leon about the year 1539, he entered the society of Jesuits at the age of fourteen, and in 1571 went to Peru, where he travelled as a missionary for seventeen years. After his return to Spain he filled several important ecclesiastical offices and died February 15, 1600, rector of the University of Salamanca. His first book, "De Natura Novi Orbis Libri Duo," was published in 1589. His "Historia Natural y Moral de las Indias" appeared in 1590, and is one of the best known and most useful of the early Spanish works on America, having passed through numerous editions in many languages.

Acosta was, perhaps, the most learned of the early writers upon America, and his writings, though modeled after those of the mediæval schoolmen, were full of suggestive observations, "touching the naturall historie of the heavens, ayre, water and earth at the West Indies, also of their beasts, fishes, fowles, plants, and other remarkable varieties of nature." He discoursed "of the fashion and form of heaven at the new-found world," "of the ayre and the winds," of ocean-physics, of volcanoes and earthquakes, as well as of metals, pearls, emeralds, trees, beasts and fowls.

He discussed the appearance and habits of the manatee and the crocodile, and described the Indian methods of whaling and pearl-fishing. He dwelt at length upon the condition of the domestic animals, sheep, kine, goats, horses, asses, dogs and cats which the Spaniards had introduced into the New World and which were already thoroughly acclimated. It seems strange to learn from his pages that in the year 1587, 99,794 hides of domestic cattle were exported from St. Domingo and New Spain to Seville. Lynceus has suggested that some of these skins were from the

bison-herds, believed at that time to have been abundant in the north of Mexico.

He gives a formidable catalogue of the animals of Central and South America, in which occur the familiar names of armadillo, iguana, chinchilla, viscacha, vicugna, paco, and guanaco, and describes many of them at length, especially the peccary (*Saino*), the tapirs, the sloths, and the vicugna. He speaks of the cochineal insect, which had already become of importance in the arts.

He was the first to call attention to the existence in South America of immense fossil bones; these he supposed to be the remains of gigantic individuals of the human species.

His description of the Flora is very full, and he dwells at length upon the useful applications of the cacao-bean and its product, the drink which they call chocolate—"whereof they make great account in that Country, foolishly and without reason,"—the plantain, the yucca, the cassava, the maguey, the tunall or cactus, and very many more.

It is, however, as a scientific theorist that Acosta has the highest claim to our attention. He appears to have been the first to discuss America from the standpoint of the zoögeographer.

In considering the question, "How it should be possible that at the Indies there should be any sorts of beasts, whereof the like are nowhere else," he owns that he is quite unable to determine whether they were special creations, or whether they came out of the ark. He evidently prefers the first alternative, although so trammelled by the prevalent opinions of his day and sect that he is unable to bring himself quite to its avowal. He approaches so close to the limits of heterodoxy, however, that Purchas, in his Pilgrimes, feels obliged to print a foot-note pronouncing it "unchristian to say that America was not drowned with the flood."

Acosta thoroughly appreciated the peculiar character of the American fauna and remarked that "if the kinds of beasts are to be judged by their properties, it would be as reasonable to call

an egg a chestnut as to seeke to reduce to the known kinds of Europe the divers kinds of the Indies." He was even willing to admit that it may not be necessary to say that the creation of the world was finished in six days, and that beasts of a more perfect character may have been made subsequently; and in his anxiety to escape the alternative of a Noah's ark almost committed himself to a theory of evolution "We may consider well upon this subject," he wrote, "whether these beasts differ in kinde and essentially from all others, or if this difference be accidentall, which might grow by divers accidents, as we see in the Images of men, some are white, others black, some Giants, others Dwarfes; and in Apes, some have no taile, others have; and in Sheepe, some are bare, others have fleeces, some great and strong with a long necke as those of Peru, others weake and little, having a short necke, as those of Castile. But to speak directly who so would preserve the propagation of beasts at the Indies, and reduce them to those of Europe, hee shall undertake a charge he will hardly discharge with his honour."

Francesco Hernandez, a representative physician and man of science, was sent by Philip II. of Spain to Mexico, with unlimited facilities for exploration, and remained in that country from 1593 to 1600. His notes and collections seem to have been very extensive, and it is said that over 1,200 drawings of plants and animals were prepared under his direction. Editions of his works were published in Mexico in 1604 and 1615. I am assured by Mexican naturalists that his work was careful and valuable, the only defect being that he trusted too implicitly in what he was told by the native Mexicans.

Among the animals not met with in previous writings are the coyote (Aztec, *Coyotl*), the buffalo, the axolotl, the porcupine (*Hoitztlacuatzin*), the prong-buck (*Mazame*), the horned lizard (*Tapayaxin*), the bison, the peccary (*Quapizotl*), and the Toucan.

Among those of which figures are for the first time published

are the ocelot (*Ocelotl*), the rattlesnake (*Teuhtlacot zanhqui*), the manatee (*Manati*), the alligator (*Aquetzpalin*), the armadillo (*Ayotochtli*), the pelican (*Ayototl*).

The figures of plants are numerous, and in most instances, I should judge, recognizable.

Many other Spaniards published their observations upon America in the sixteenth and seventeenth centuries, but it is perhaps not necessary to refer to them even by name. They were, as a rule, travellers, not explorers. Purchas assures us that "Acosta and Oviedo have best deserved of the studious of Nature—that is, of the knowledge of God in his workes."

III.

A personage who must on no account be overlooked in the consideration of these early days is Garcilasso de la Vega. Born in Peru in 1530, his father the Spanish governor of Cuzco, his mother a princess of the Inca blood, he boasted of a lineage traced through the line of ancient Peruvian monarchs back to Manco Capac and the Sun. He served as a soldier in Europe and died in Spain about the year 1615. His "Royal Commentaries of Peru," constitutes a magnificent contribution to the history of pre-Columbian America, and was said by some authorities to have been first written in the Peruvian language.*

Be this as it may, De la Vega's commentaries, though more valuable to the civil than to the natural historian, will always possess a peculiar interest, not only because the author was the first native of America who wrote concerning its animals and plants, but for the reason that it represents to us the historic and scientific lore of the aboriginal inhabitants of this continent.

* A Paris edition of 1633 had the following title: Commentaire Royal ou l'Histoire des Yncas, Roys de Peru, &c. Ensemble une description particulière des Animaux, des Fruits, des Mineraux, des Plantes, &c., Ecrité en langue Peruvienne et traduit sur la version Espagnole, par Baudouin, Paris, 1633. Amsterdam, 1704 and 1715. See Artedi, Bibliotheca Ichthyologica, 1788, p. 65.

De la Vega describes in an intelligible manner the condor (*Cuntur*) of South America, of which, as he tells us, there was a famous Indian painting in the temple at Cacha, the mountain cats or ocelots (Inca *Ozcollo*, Aztec *Ocelotl*), the puma, the viscacha, the tapir, and the three-toed ostrich. He was one of the first to notice the skunk (*Mephitis*, sp.), "which the Indians call Anas, the Spanish *Zorinnas*." "It is well," he remarks, "that these creatures are not in great numbers, for if they were, they were able to poison and stench up a whole Countrey." He devotes a chapter to "the tame cattel which God hath given to the Indians of Peru"—the llama and the huanaco—and speaks also of the paco and the vicuna, clearly distinguishing and describing the appearance and habits of the four species of Tylopoda which occur on the west coast of South America, although European naturalists a century later knew but two of them. He describes the annual vicuna hunts which were conducted by the Inca kings in person, assisted by twenty or thirty thousand Indians.

The fauna of Peru, as catalogued by him, included nearly fifty species, and the minuteness of his observations and the accuracy of his descriptions are very surprising. He discusses at length the plants of Peru, especially the maguey, the pineapple, the tobacco, and "the pretious leaf called *Cuca*," whose virtues pharmacologists now hold in such high esteem, and devotes chapters to "The Emeralds, Turquoises and Pearls of that Countrey;" to gold and silver, and to quicksilver.

De la Vega refers to a certain place in the city of Cuzco, where lions and other fierce creatures were kept in captivity. The taste for menageries and gardens seems to have been less pronounced in Peru, however, than in Mexico.

Much has been written concerning the wonderful collections of animals and plants which the Spanish conquestadors found in Montezuma's capital city. Carus, in his "Geschichte der Zoölogie" declares that at the time of the discovery of Mexico, Europe

had no menageries and botanical gardens which could be compared with those of Chapoltepec and Huaxtepec, a statement which is quite within the bounds of truth, for the earliest botanical garden in the old world was that founded at Pisa in 1543.* Our fellow-member, Dr. Charles Rau, has also described the zoölogical gardens of Mexico in glowing terms,† and Prof. E. B. Tylor states that in the palace gardens of Mexico all kinds of birds and beasts were kept in well appointed zoölogical gardens where there were homes even for alligators and snakes, and declares that this testifies to a cultivation of natural history which was really beyond the European level of the time.

Is it not to be regretted that the capital of the United States in 1885 is still unprovided with a means of public instruction which was to be found in the capital of Mexico four hundred years ago?

I have examined the historians of Mexico with care and must express my conviction that the truth is more nearly touched in the bluff, soldier-like narrative of Cortez himself, than in the flowery and redundant paraphrases of Prescott. We may probably safely accept the story as told by Bernal Diaz del Castillo, one of the companions of Cortez, to whom Torquemada, Robertson, Lockhart, Rau and others give high praise as a truthful narrator.

Diaz presents a most vivid word-painting of the city of Mexico, and was particularly impressed by the royal aviaries:

"We saw here every kind of eagle, from the king's eagle‡ to the smallest kind included, and every species of bird from the largest known to the little colibris§ in their full splendor of plumage. Here also were to be seen those birds from which the Mexicans take the green colored feathers of which they manufacture their beautiful feathered stuffs; these last-mentioned birds very

* WHEWELL: *History of the Inductive Sciences*, iii, p. 325.

† CARL RAU: *Thiergärten.* < New Yorker Staats-Zeitung, April 26, 1863.

‡ The golden eagle, says Aguilera.

§ Humming-birds.

much resemble our Spanish jays and are called by the Indians *quezales*.*

"The species of sparrows † were very curious, having five distinct colors in their plumage—green, red, white, yellow, blue.

"There were such vast numbers of parrots and such a variety of kinds that I cannot remember all their names; and geese of the richest plumage and other large birds.

"These were at stated periods stripped of their feathers, that new ones might grow in their place. All these birds had appropriate places to breed in and were under the care of several Indians of both sexes, who had to keep their nests clean, give to each kind its proper food, and set the birds for breeding."

In another place, near a temple were kept all manner of beautiful animals, the names of which were not noted by Diaz, nor their peculiarities described.

"In the building where human sacrifices were perpetrated there were dens in which were kept poisonous serpents and among them 'a species at the end of whose tail there was a kind of rattle.' This last-mentioned serpent, which is the most dangerous, was kept in a cabin in which a quantity of feathers had been strewed: here it laid its eggs, and it was fed with the flesh of dogs and of human beings which had been sacrificed.

* * * When all the tigers and lions ‡ roared together with the howlings of the jackals § and foxes and hissing of the serpents, it was quite fearful, and you could not suppose otherwise than that you were in hell."

This is the first record of the rattlesnake, and brings to mind the captive snakes of the Mokis, their annual snake dance, and their use of feathers in the same connection. ‖

I am not yet prepared to believe in the marvellous aquaria described by Prescott, although fish ponds there doubtless were.

I am assured by our fellow member, Senor Aguilera, that the locations of the gardens of Montezuma are well identified and that the Mexican Indians still possess a marvellous knowledge of the medicinal virtues of plants, which is handed down by tradition

* Trogons, known as *quetzales* by the Mexican Indians of to-day. Excellent examples of their pictorial use of trogon feathers may be seen in the U. S. National Museum.

† *Cyanospiza versicolor.*

‡ Ocelots, jaguars, pumas, eyras, jaguarundis.

§ The coyote (*coyotl*), *Canis latrans.*

‖ See BOURKE: *The Snake Dance of the Moquis of Arizona*, New York, 1884.

from generation to generation. From this he infers that in the days of Aztec glory, the knowledge of the uses of plants must have been very comprehensive.

Who shall say that the spirit of true science did not inspire the Inca Pachacutec, when many centuries ago he handed down to his descendants maxims such as this:

"A herbalist who knows the names but is ignorant of the virtues and qualities of herbs, or he who knows few but is ignorant of most, is a mere quack and mountebank, and deserves not the name and repute of a physician until he is skilful as well in the noxious as in the salutiferous qualities of herbs."

Impressed with the extent of the knowledge of nature among the aborigines of America, I asked one of the most learned of our anthropologists for his opinion in regard to its character, and received the following statement:

WASHINGTON, *January* 5, 1886.

MY DEAR MR. GOODE:

We make a very grave mistake if we think there was no study of nature before the science of natural history. In all branches of study whatever there was lore before there was science. Before the weather bureau was weather lore, a kind of rough induction which the ancient people made, and which was very far from erroneous. Dr. Washington Matthews read a paper before the Washington Philosophical Society more than a year ago* to draw attention to the marvellous intimacy of the Navajo Indians with the plant kingdom around them, and their vocabulary which contained names for many species constructed so as to connote qualities well known to them. You are familiar with the stories concerning the respect in which certain animals are held by the Eskimo, and the minute acquaintance of all our aborigines of both continents with the life histories of many animals. The Eskimo as well as the Indian tribes carve and depict forms so well that the naturalist can frequently determine the species. Mr. Lucien Turner collected carvings in ivory of fœtal forms.

Very truly yours,

O. T. MASON.

Professor Mason also called attention to a long paper upon

*WASHINGTON MATTHEWS: *Natural Naturalists.* < Bull. Phil. Soc. Washington, vii, 1885, p. 73, (abs.)

"Tame Animals Among the Red Men of America," by Dr. E. F. im Thurn,* in which it is stated that the Indian of South America finds means to tame almost every wild bird and beast of his country, so that these domesticated animals are ever among the most prominent members of his household, not because of any affection for them, but because he enjoys their bright colors, makes use of them in various ways, and employs them as a medium of exchange. They even know how to change the colors of a living bird from green to yellow. In one settlement he counted twenty-one kinds of monkeys. Nearly all of the thirty or more species of Guiana parrots are tamed, two species of deer, two of peccaries, two of coati-mundis, jaguars, pacas, capybaras, agoutis, hawks, owls, herons, plovers, toucans, troupials, rupicolas, and iguanas were also observed in captivity. The mere fact that these animals are kept in captivity is not in itself especially significant, but it renders it possible to understand how the splendor-loving rulers of Mexico succeeded in building up their great menageries.

Bearing in mind the animal myths which Major Powell has found so prevalent among the Indians of Arizona and New Mexico, and has so charmingly translated, and those which Schoolcraft and others recorded in the north long ago, and which Longfellow has arranged in metric form, we cannot but be impressed with the idea that the red man of old, living close to nature as he did, knew many of her secrets which we should be glad to share with him at the present day.

Garcilasso de la Vega was not the only descendant of the aboriginal Americans who has written upon their history. Among the authors of works upon Mexican archæology published in the seventeenth and eighteenth centuries were Taddeo de Niza and Gabriel d'Ayala, "noble Indians" of Tlazcala and Tezcuco, the

*Timehri, being the Journal of the Royal Agricultural and Commercial Society of British Guiana. Demerara, vol. 1, 1882, pp. 25–43.

three named Ixtlilxochitl, and ten or twelve more. Gongora, a native Mexican, professor of mathematics in the University of Mexico, was one of the earliest American astronomers, the author of the "Mexican Cyclography," printed two centuries ago. Herrera, Martinez, Garcia, Torquemada, Castillejo, De Betancourt, De Solis, Del Pulgar, and Beneducci have done what they could to preserve a portion of this ancient American lore, and it seems almost incredible that, some time in the future when American archæology shall have gained a firmer footing, some of the treasures of fact which these men garnered up are not to have an important function in elucidating anthropological problems which are as yet entirely unsolved.

IV.

The colony on Roanoke Island having been abandoned by the English, twenty years elapsed before their next effort toward peopling America. Then came the adventurers to Jamestown in 1606, and with them that picturesque personage, Captain John Smith, who, though unversed in the mathematics and astronomy which made up to a great extent the science of the day, was a keen observer, and an enterprising explorer. His contributions to geography were important, and his descriptions of the animals and plants of Virginia and New England supplement well those of his predecessor, Harriott.

Captain Smith was the first to describe the raccoon, the musquash, and the flying squirrel:

"There is a beast they call *Aroughcun* (raccoon), much like a badger, but useth to live on trees, as Squirrels doe. Their Squirrels some are neare as great as our smallest sort of wilde Rabbets, some blackish, or blacke and white, but most are gray. A small beast they have they call *Assapanick*, but we call them flying Squirrels, because, spreading their legs, and so stretching the largenesse of their skins that they have been seene to fly 30 or 40 yards. An *Opossum* hath a head like a Swine, and a taile like a Rat, and is of the bignesse of a Cat. Vnder her belly she hath a bagge, wherein she lodgeth, carrieth, and suckleth her young. A

Mussascus (musquash) is a beast of the forme and nature of our water Rats, but many of them smell exceedingly strongly of Muske."

And in the same strain he goes on to mention a score of mammals, identifying them with those of Europe with surprising accuracy.

His "*Utchun quoyes*, which is like a Wild Cat," is evidently the bay lynx. With the birds he was less familiar, but he mentions a number which resemble those of Europe, and states that many of them were unfamiliar. He was the first to refer to the red-wing blackbird (*Agelæus phœniceus*).

He catalogues 25 kinds of fish and shell-fish, using the names by which many of them are known to this day.

He gives also a very judicious account of the useful trees of Virginia, referring, among novel things, to the Chechinquamin, (chinkapin), and another which no one can fail to recognize.

"Plums," he says, "are of three sorts. * * * That which they call *Putchamins* grow as high as a *Palmeta;* the fruit is like a Medler; it is first greene, then yellow, and red when it is ripe; if it be not ripe it will draw a man's mouth awry with much torment."*

In his description of New England, Smith mentions twelve species of mammals, including the "moos," now spoken of for the first time,† 16 of birds, and 27 "fishes." His descriptions of the abundance of fishes are often quoted.‡

Smith's first work upon Virginia was printed in 1612 and his General History in 1624. In the interim, Raphe Hamor, the younger, secretary of the Colony, issued his "True Discourse of the Present Estate of Virginia," published in London in 1615.§

* *Generall Historie*, 1624, p. 27.

† From the Indian word *Moosoa*. Slafter, in his notes on Champlain's Voyages, i, p. 265, supposes the *Orignac* referred to by this explorer in his De Sauvages, etc., Paris, 1607, to have been the Moose, and his *Cerf* to have been the Caribou.

‡ *Generall Historie*, pp. 216–17.

§ A copy of this rare work was sold in London, 1883, for 69 pounds. A

Hamor was not a naturalist, but his name is usually referred to by zoölogical bibliographers, since he mentions by name over sixty native animals. He was the first to describe the great flocks of wild pigeons, of which he remarks: "In winter, beyond number or imagination, myselfe hath seene three or foure houres together flockes in the aire so thicke that even they have shadowed the skie from us."* He gives an amusing description of the "opossume," and also speaks of the introduction and successful acclimation of the Chinese silk-worm.

In 1620, the Plymouth Colony was planted, and its members also began to record their impressions of the birds and the beasts and the plants which they found, for the instruction of their kinsfolk at home.

Bradford and Winslow's Journal, printed in London in 1622, contains various passing allusions to the animals and plants observed by the Pilgrims, as does also Bradford's History, which, however, was not printed until long after its completion. They added nothing, however, to what had already been said by Smith.

Edward Winslow's "News from New England," printed in London in 1624, contains one of the earliest descriptions of the Indians of the Northeast.

William Wood's "New England's Prospect," which was issued in London in 1634, and Morton's "New English Canaan," printed three years later in Amsterdam, were the first formal treatises upon New England and its animals and plants. The two authors were very unlike, and their books even more so—yet complementing each other very satisfactorily. Morton was the best educated man, brightest, and most observant; Wood, the most conscientious and the most laborious in recording minute details.

"Thomas Morton, of Clifford's Inn, Gent.," was by no means

reprint was issued by Joel Munsell at Albany in 1860, but this privately printed edition consisted of only 200 copies and it is already scarce.

* P. 21.

a representative man in the Puritan community in which he lived. His habits were those of an English man of fashion, and his Rabelaisian humor, when directed against his fellow-colonists and their institutions, was no recommendation to their favor. We cannot wonder that he was hunted from settlement to settlement and even cast into prison, to endure, without bedding or fire, the rigor of a New England winter.

As a naturalist, Morton appears to have been the most accurate of the two of this time. In those parts of his book which describe animals and plants he manifests a definite scientific purpose. He discriminates between species, and frequently points out characters by which American and European forms may be distinguished. He was the first to banish the lion from the catalogue of the mammals of eastern North America. Even Wood, though he admitted that he could not say that he ever saw one with his own eye, evidently believed that lions inhabited the woods of Massachusetts. Morton was a skeptic because, as he said, "it is contrary to the Nature of the beast to frequent places accustomed to snow; being like the Catt, that will hazard the burning of her tayle, rather than abide from the fire." His brief biographies, especially those of mammals, indicate that he was an observer of no slight acuteness.

Twenty species of mammals, thirty-two of birds, twenty of fishes, eight of marine invertebrates, and twenty-seven of plants are mentioned, usually in such definite terms that they may readily be identified.

A thorough pagan himself, he seems to have commanded the confidence of the Indians more than others, to have lived in their society, and learned to comprehend the meaning of their customs. His first book, "The Originall of the Natives, their manners and customs," seems to have been the careful record of rather critical observations.

Wood's book is no less deserving of praise. The climate and the soil are judiciously discussed, and the herbs, fruits, woods,

waters, and minerals, then "the beasts that live on land," "beasts living in the water," "birds and fowls both of land and water," and fish, after which follows a topographical description of the colony. His catalogues of species are in verse, and his adjectives are so descriptive and pictorial that his subsequent remarks in prose are often superfluous. I quote his catalogue of the trees of New England, an imitation in manner and metre of Spenser's famous catalogue in The Faerie Queene:

Trees both in hills and plaines in plenty be
The long liv'd Oake, and mourneful Cypris tree
Skie towring pines, and Chestnuts coated rough,
The lasting Cedar and the Walnut tough;
The rozin dropping Firre for masts in use.
The boatmen seeke for Oares light neeate growne sprewse,
The brittle Ash, the ever trembling Aspes,
The broad-spread Elme, whose concave harbours waspes
The water-springie Alder, good for nought
Small Elderes by the Indian Fletchers sought
The knottie Maple, pallid Birtch, Hawthornes,
The Horne bound tree that to be cloven scornes;
Which from the tender Vine oft takes his spouse,
Who twinds embracing armes about his boughes.
Within this Indian Orchard fruites be some
The ruddie Cherrie, and the jettie Plumbe
Snake murthering Hazell, with sweet Saxaphrage
Whose steemes in beere allays hot fever's rage.
The Diar's Shumach, with more trees there be
That are both good to use and rare to see.

Thus he describes the "Animals of New England:"

The Kingly Lyon and the strong arm'd Beare
The large limbed Mooses, with the tripping Deare.
Quill darting Porcupines, and Rackcoones bee
Castelld in the hollow of an aged Tree
The skipping Squirrel, Rabbet, purblinde Hare
Immured in the selfe same Castle are
Least red-eyed Ferrets, wily Foxes should
Them undermine if ramperd but with mould.
The grim fac't Ounce, and ravenous howling Woolfe
Whose meagre Paunch suckes like a swallowing Gulfe,
Black glistening Otters and rich coated Beaver
The Civet scented Musquash, smelling ever.

His subsequent remarks upon the mammals are expanded from his rhyme, and extended by tales which he has heard from hunters. One of the animals whose name would not lend itself to

poesy is the "squuncke," which he classified among the "beasts of offence." This seems to be the first use of the name.

In the second part of Wood's book the Indians are discussed, and a very creditable vocabulary is given.

Most admirable work was now being done among the Indians by some of the colonial clergymen. Chief among them was the Rev. John Eliot, [b. 1604, d. 1690], who, during a residence of more than half a century at Roxbury, mastered the language of the Massachusetts branch of the great Algonquin tribe, and published his grammars and translations. He was a graduate of Jesus College, Cambridge, and came to Massachusetts in 1631. The Rev. Abraham Peirson, one of the founders of the colony at Newark, during his residence in New England made valuable investigations upon the language of the Quiripi or Quinnipiac Indians of the New Haven Colony. The extensive bibliography of which Mr. Pilling has recently published advance sheets gives an excellent idea of the attention which American linguistics have since received.

That very eminent colonial statesman, John Winthrop, the younger, the first Governor of Connecticut, [b. 1587, d. 1649], stood high in the esteem of English men of science, and was invited by the newly founded Royal Society, of which he was a fellow, "to take upon himself the charge of being the chief correspondent in the West, as Sir Philiberto Vernatti was in the East Indies." The Secretary of the Royal Society said of him: "His name, had he put it to his writings, would have been as universally known as the Boyles, the Wilkins's, and the Oldenburghs, and been handed down to us with similar applause."*

Governor Winthrop's name occurs from time to time in the Philosophical Transactions, and it was to him that science was indebted for its first knowledge of the genus *Astrophyton*.

John Winthrop, F. R. S., [b. 1606, d. 1676], son of the last,

*Dr. Cromwell Mortimer in the Dedication of vol. xl, Philosophical Transactions.

and also Governor of Connecticut in 1662, is said to have been "famous for his philosophical knowledge." He was a founder of the Royal Society, being at the time of its origin in England as agent of the colony. And the second Governor's grandson, John Winthrop, F. R. S., [b. 1681, d. 1747), who passed the latter part of his life in England, was declared to have increased the Royal Society's repository "with more than six hundred curious specimens, chiefly in the mineral kingdom," and since the founder of the museum of the Royal Society, "the benefactor who has given the most numerous collections."*

The Rev. John Clayton, rector of Crofton, at Wakefield, in Yorkshire, made a journey to Virginia in 1685, and in 1688 communicated to the Royal Society "An account of several observables in Virginia and in his voyage thither."† Clayton seems to have been a man of scientific culture, and to have been the author, in company with Dr. Moulin, of a treatise upon Comparative Anatomy. He was of the same school with Harriott and Wood, though more philosophical. His essay was, however, the most important which had yet been published upon the natural history of the South, and his annotated catalogue of mammals, birds and reptiles is creditably full.

Thomas Glover also published about this time "An Account of Virginia,"‡ in which he discussed the natural history of the colony after the manner of Wood and Morton. The Rev. Hugh Jones also published a similar but shorter paper upon "Several Observables in Maryland,"§ in which, however, no new facts are mentioned. He collected insects and plants for Petiver.

Benjamin Bullivant, of Boston, was another of the men who, to use the language of the day, was "curious" in matters of nat-

* Tuckerman, *op. cit.*, pp. 123–4. See also *The Winthrop Papers.* < Mass. Hist. Soc. Coll., Fifth Series, vol. viii.

† Phil. Trans, xvii, pp. 781–795, 978–999; xviii, pp. 121–135, and in *Miscellanea Curiosa*, vol. iii; also reprinted in Force's Historical Tracts, vol. iii.

‡ Phil. Trans., ix, p. 633.

§ Phil. Trans., xxi, p. 436.

ural history. One of his letters was published in the Philosophical Transactions,* and his notes on the "hum-bird" are sometimes referred to.

Bullivant was not a naturalist; he is less worthy of our consideration than Harriott, although a century later. A fit companion for Bullivant was John Josselyn.

Josselyn's famous work entitled "New England's Rarities Discovered in Birds, Beasts, Fishes, Serpents, and Plants of that Country," was printed in London in 1672; his "Account of two voyages to New England" in 1675, ("Second Addition"). No writer of his period is more frequently quoted than Josselyn, whose quaint language and picturesque style are very attractive. Although no more in sympathy with his Puritan associations than the author of "New England's Prospect," he was evidently more justly entitled to subscribe himself as "Gentleman," and his books are not disfigured by personalities and political aspersions.

Josselyn does not seem to me to be the peer, as a naturalist, of many of those who preceded him. He was a bright, though superficial man, and a ready compiler. He evidently had some botanical work in his possession, possibly as Tuckerman has suggested, a recently published edition of Gerard's "Herbal," and this he used with such skill as to give him a certain standing in botanical literature. In his zoölogical chapters I find little which had not been recorded before, while the author's fondness for startling anecdotes greatly mars the semblance of accuracy in his work. His catalogue of fishes is a strange olla-podrida of names and scraps of information, compiled, collected and invented. His method of arrangement is not more scientific than his spirit, and it is questionable whether he is entitled to a place among naturalists.

Here is an example of his style:

"The Basse," writes he, "is a salt-water fish too; one writes

* Phil. Trans., xx, p. 168.

that the fat in the bone of a Basses head is his braines, which is a lye."

To this period belongs, also, Lawson, the author of a "History of North Carolina" and "A New Voyage to North Carolina," made in 1700 and the following years, while acting as surveyor general of the colony. Lawson was burnt at the stake in 1709 by the Indians, who resented his encroachments upon their territory. His lists of the animals and plants of the region are very full and his observations accurate. Coues's "Lawsonian period" in the history of American ornithology is hardly justifiable. Lawson belonged to the school of Harriott and the first Clayton.

Edward Bohun and Job Lord, of Carolina, appear to have been interested in natural history at this time and to have been collecting specimens for Petiver in London, while William Vernon was engaged in similar occupations in Maryland.

In those early days all Europe was anxious to hear of the wonders of America, and still more eager to see the strange objects which explorers might be able to preserve and bring back with them. Public museums were as yet unknown, but the reigning princes sought eagerly to secure novelties in the shape of animals and plants.

Columbus was charged by Queen Isabella to collect birds, and it is recorded that he took back to Spain various skins of beasts. Even to this day may be seen, in Siena, hanging over the walls of the old collegiate church, a votive offering, placed there nearly four centuries ago by the discoverer of America, then in the prime of his glory. It consists of the helmet and armor worn by him when he first stepped upon the soil of the New World, and the rostrum of a swordfish killed on the American coast.

The State papers of Great Britain contain many entries of interest to naturalists. King James I. was an enthusiastic collector. December 15, 1609, Lord Southampton wrote to

Lord Salisbury that he had told the King of the Virginia squirrels brought into England, which were said to fly. The King very earnestly asked if none were provided for him—whether Salisbury had none for him—and said he was sure Salisbury would get him one. The writer apologizes for troubling Lord Salisbury, "but," he continues, "you know so well how he (the King) is affected to such toys."

Charles I. appears to have been equally curious in such matters. In 1637 he sent John Tradescant, the younger, to Virginia "to gather all rarities of flowers, plants, and shells."

In 1625 we find Tradescant writing to one Nicholas that it is the Duke of Buckingham's pleasure that he should deal with all merchants from all places, but especially from Virginia, Bermudas, Newfoundland, Guinea, the Amazons, and the East Indies for all manner of rare beasts, fowls and birds, shells and shining stones, et cetera.*

In the Domestic Correspondence of Charles I. in another place,† July, 1625, is a "Note of things desired from Guinea, for which letters are to be written to the merchants of the Guinea company." Among other items referred to are "an elephant's head, with the teeth very large; a river-horse's head; strange sorts of fowls: birds' and fishes' skins; great flying and sucking fishes; all sorts of serpents; dried fruits, shining stones, etc." Still further on is a note of one Jeremy Blackman's charge—in all, £20—for transporting four deer from Virginia, including corn and a place made of wood for them to lie in.‡

Not only did the kings make collections, but the keepers of public houses made museums then, as they do now, for the pleasure of their patrons.

At the middle of the last century there appear to have been several collections of curiosities.

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* *Calendar of Colonial Papers*, 1625, p. 75.
† Vol. iv, Nos. 155–6. Cal., p. 77.
‡ *Calendar of Colonial Papers*, p. 285.

In Artedi's ichthyological works there are numerous references to places where he had seen American fishes, especially at Spring-garden,* and at "the Naggshead," and the "White-bear," and the Green Dragon in Stepney, in those days a famous hostelry in London. He speaks also of collections at the houses of Mr. Lillia and Master Saltero's† in Chelsey and at Stratford, and also in the collection of Seba, in Amsterdam, and in that of Hans Sloane.

With the exception of "*the monk* or *Angel-fish*, *Anglis*, aliis *Mermaid-fish*," probably a species of *Squatina*, which he saw at the Nag's Head, all the fishes in these London collections belonged to the order Plectognathi.

Josselyn, after telling us how a Piscataway colonist had the fortune to kill a Pilhannaw—the king of the birds of prey—continues, "How he disposed of her I know not, but had he taken her alive and sent her over into England, neither Bartholomew or Sturbridge Fair could have produced such another sight."‡

Shakespeare's mirror strongly reflects the spirit of the day. When Trinculo, cast ashore upon a lonesome island, catches a glimpse of Caliban he exclaims:

"What have we here? A man or a fish? Dead or alive? A fish: he smells like a fish; a very ancient and fish-like smell. * * * A strange fish! Were I in England now, as once I was, and had but this fish painted, not a holiday fool there but would give a piece of silver; there would this monster make a man; any strange beast there makes a man; when they will not give a doit to relieve a lame beggar, they will lay out ten to see a dead Indian."§

The compilers of the great encyclopædia-like works on natural history were quick to pick up the names and descriptions of the American animals which had found their way to Europe, and

* Later known as Vauxhall Gardens, a famous place of resort.

† The barber-virtuoso, described in Bulwer's "Devereux."

‡ Josselyn: *Two Voyages to New England* (1638–1673).

§ *A Winter's Tale.*

many such are mentioned in the writings of Gesner, Clusius and Aldrovandus, Lister, Laet and Willughby.*

Creatures of remarkable appearance, which could be preserved with ease were the first to become known. Among fishes, for instance, those with a hard, inflexible integument, such as the trunk-fishes. Every species of the family *Ostraciontidæ* was known in Europe as early as 1685; most of them probably a century before. We know that Columbus caught a trunk-fish and described it in his "Voyages."

Professor Tuckerman has traced in a most instructive manner the beginnings of European acquaintance with American plants, finding traces of the knowledge of a few at a very early period:

"Dalechamp, Clusius, Lobel, and Alpinus—all authors of the sixteenth century—must be cited occasionally in any complete synonomy of our *Flora*. The Indian corn, the side-saddle flower (*Sarracenia purpurea* and *S. flava*), the columbine, the common milk-weed (*Asclepias cornuti*), the everlasting (*Antennaria margaritacea*) and the *Arbor vitæ*, were known to the just mentioned botanists before 1600. *Sarracenia flava* was sent, either from Virginia, or possibly from some Spanish monk in Florida. Clusius's figure of our well-known northern *S. purpurea* was derived from a specimen furnished to him by one Mr. Claude Gonier, apothecary at Paris, who himself had it from Lisbon, whither we may suppose it was carried by some fisherman from the Newfoundland coast. The evening primrose, *Oenothera biennis*, was known in Europe, according to Linnæus, as early as 1614. *Polygonum sagittatum* and *arafolium* (tear thumb) were figured by DeLaet, probably from New York specimens, in his *Novus Orbis*, 1633. Johnson's edition of Gerard's "Herbal," 1636, contains some dozen North American species, furnished often from the garden of Mr. John Tradescant and John Parkinson, whose "Theatrum Botanicum" (1640) is declared by Tournefort to embrace a larger number of species than any work which had gone before. It describes a still larger number.†

* In Nehemiah Grew's "Catalogue and description of the natural and artificial Rarities, belonging to the Royal Society and preserved at Gresham College, Whereunto is subjoined the comparative Anatomy of Stomachs and Guts," London, 1681, are descriptions and figures of many American animals.

† *Archæologia Americana*, iv, pp. 116–117.

All the early voyagers were striving for the discovery of a western passage to India, and the West Indies, so-called, were considered simply a stage on the journey towards the East Indies. It is not strange, therefore, that writers should often have failed to distinguish the faunal relations of the animals which they described. Many curious paradoxes in nomenclature have thus arisen—*Cassis madagascariensis*, for instance; a very misleading name for a common West Indian mollusk.

V.

The seventeenth century bears upon its roll the names of many explorers besides those of English origin who have already been named. Within fifty years of the time of Harriott and of the planting of the colony at Roanoke, the number and extent of the European settlements in America had become very considerable. Virginia and the New England plantations were growing populous and Maryland was fairly established. Insular colonies were thriving at Newfoundland and Bermuda and on Barbados, and elsewhere in the West Indies.

New Spain and Florida marked the northern limits of the domain of the Spaniards, who had already overrun almost all of South America.

New France bounded New England on the north, and the French were pushing their military posts and missionary stations down into the Mississippi valley.

The Dutch were established on Manhattan Island and elsewhere in the surrounding country, and the Dutch West India Company had already a foothold in Brazil and Guiana. A colony of Scandinavians had been planted by the Swedish West India Company near the present site of Philadelphia, and the forsaken Danish colonies of Greenland were soon to be re-established. The Portuguese had flourishing settlements in Brazil, for the possession of which they were contending with the Dutch.

Every European nation was represented in the great struggle

for territory save Italy and Germany, Switzerland and Russia; but the Italians and Germans, the Swiss and the Russians were to hold their own in the more generous emulation of scientific exploration which was to follow.

During the 17th and 18th centuries numerous explorations were made both in North and South America by Spanish, French, Dutch, German, and Scandinavian explorers. Although these men have been studied in the preparation of this address, I do not intend to speak of them at any length, but to confine my attention in the main to the growth of scientific opinions and institutions in the English colonies.

The number of volumes of reports and narratives, often sumptuously printed and expensively illustrated, which were published during the seventeenth and eighteenth centuries, impresses upon one most powerfully the idea of the earnestness, diligence, and intelligence of their writers.

The Spaniards.—Even as early as the beginning of the century, Spanish influence was less prominent in the affairs of the New World; in no respect more strikingly so than in explorations. The political supremacy of Spain was gone, her intellectual activity was waning, and the mighty storm of energy, by which her domain in America had been so suddenly and widely established, seemed to have completely exhausted the energy of her people, depleted as it had been by wars without and religious persecution within.

From this time forward the record of Spanish achievements in the fields of science and discovery is very meagre. Between the day of Hernandez and that of Azara and Mutis, who explored South America in the latter part of the eighteenth century, I find but two names worthy of mention, and these seem properly to belong with the naturalists who lived a hundred years before them. I refer to José Gumilla who published, in 1741, a work on the natural history of the Orinoco Region, and Miguel Venegas, whose "Noticia de la California" appeared in 1757.

The French.—One of the first French explorers who left a record of his observations was Samuel de Champlain, who made a voyage to the West Indies and Mexico, 1599–1602, and began his travels in New France in 1603. He was the founder of Quebec, where he died in 1635, and his geographical explorations and maps are of great value. His observations upon the animals and plants are disappointing. He describes the gar-pike and the king-crab, already described and figured by Harriott many years before, and refers in unmistakable terms to the shearwater, the caribou, the wild turkey, and the scarlet tanager. His lists of animals which occur now and again in the course of his narrative are too vague to be of value.*

Much higher in the esteem of naturalists was Gabriel Sagard Theodat, a Franciscan friar, whose "Grand Voyage Du Pays Des Hurons," printed in 1632, was the most scholarly work upon America which had yet appeared, and whose History of Canada and of the journeys made by the Franciscans for the conversion of the infidels also contains most valuable records.

The first work on the plants of North America was that of Cornuti—"Canadensium Plantarum, aliarumque nondum editarum Historia"—printed in Paris in 1635, which described thirty-seven species, thirty-six of these being illustrated by elaborate engravings upon copper. The botanical part of this treatise is usually ascribed to Vespasian Robin, and Tuckerman supposes that the local notes, as well as the specimens described, were probably the result of the labors of the worthy Franciscan missionary, Sagard.†

A few years later, Pierre Francois Xavier de Charlevoix, [b. 1682, d. 1761], a Jesuit priest, having by royal command travelled through the northern part of North America, published his "Histoire et Description Générale de la Nouvelle France,"

*Publications of Prince Society, Boston, 1878. Hakluyt Society, vol. xxiv, 1850.

† *Archæologia Americana*, iv, p. 119.

Paris, 1744, which was full of important biological and ethnological observations, the accuracy of which is not questioned.

He subsequently travelled in South America, and published in 1760, a work full of statements concerning the animals, plants, and fruits of that country, and also particularly interesting from the account which it gives of the singular Jesuit establishment in Paraguay.

Other French missionaries, Brebœuf, Du Poisson, Jaques, Joliet, La Chaise, Lallemand, Marquette, Senat, and Souel followed Charlevoix in the exploration of these regions. Their works contain many valuable notes upon animals and plants.

Jean Baptiste du Tertre, in his "Histoire Générale des Antilles, habitées par les Francois," published in Paris in 1654, [ed. 1654–1667], described and illustrated many of the New World animals.

In 1672 Nicolas Denyse published in Paris two comprehensive works upon America, viz: "Histoire Naturelle des Peuples, des Animaux, des Arbres et des Plantes de l'Amérique,"* and "Description Geographique des costes de l'Amérique Septentrionale, avec l'Histoire Naturelle du Pays."†

F. Froger, a companion of De Gennes in his voyage made in 1695–97 to the coast of Africa, the Straits of Magellan, Brazil, Cayenne and the Antilles, published a report in 1698.‡ The book has been overlooked by recent bibliographers, but, judging from Artedi's remarks upon its ichthyological portion, it was fully equal to similar works of its day.

Baron de la Hontan, Lord Lieutenant of the French Colony at Placentia, printed at the Hague in 1703 his "Voyages dans l'Amérique," which is sometimes referred to by zoölogists.

Louis Feuillée, who travelled by royal commission from 1707–12 in Central and South America, published four volumes of physical mathematics and botanical observations, 1714–25, in Paris.

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* Paris, 1672, 8°. † 1672, 12°, 2 vol.

‡ Paris, 1698; Amsterdam, 1699; London (translation), 1698.

The Père Jean Baptiste Labat, visited the West Indies as a missionary early in the eighteenth century, and "Nouveau Voyage aux Isles de l'Amérique," printed in Paris, 1722, is very full of interesting and copious details of natural history.

The Père Laval, visited Louisiana, and published in Paris, 1728, his "Voyage de la Louisiane."

M. LePage DuPratz followed, in 1758, with his "Histoire de la Louisiane,"* full of geographical, biological, and anthropological observations upon the lower valley of the Mississippi, and Captain Bossu, of the French Marines, also published a book upon the same region,† translated into English in 1771 by John Rembold Forster, whose notes gave to the work its only value. These men are all catalogued with the seventeenth century naturalists because they were of the old school of general observers and only indirectly contributed to the progress of systematic zoölogy.

Charles Plumier [b. 1646, d. 1704] was sent thrice by the King of France to the Antilles during the latter years of the seventeenth century. He published three magnificently illustrated works upon the plants of America,‡ and left an extensive collection of notes and drawings of animals and plants, many of which have proved of value to naturalists of recent years. His colored drawings of fishes were of great service to Cuvier in the preparation of his great work upon ichthyology, and in some instances species were founded upon them.

The Dutch.—There were few lovers of nature among the colonists of Manhattan, and with the exception of certain names which have clung to well-known animals, such as the mossbunker and weakfish, naturalists have little to remind them of the days of Van Twiller and Stuyvesant. Van Der Donck, in 1659, de-

* Paris, 1758.

† *Nouveaux Voyages aux Indes Occidentales*, etc., Paris: 1768.

‡ 1693. *Nova Plantarum Americanarum Genera*, 1703. Traité de Fougéres d'Amérique, 1705.

scribed the fauna, and Jakob Steendam's poem, "In Praise of the Netherlands," catalogued many of the animals.

The achievements of Prince Maurice of Nassau, [b. 1604, d. 1679], the conqueror of Brazil, during his residence in that country from 1636 to 1644, were far more important than those of any one man in the seventeenth century, and entitled the Netherlands to a leading place in the early history of American scientific explorations. The notes and figures which were collected by him and his scientific assistants, Marcgrave, Piso, and Cralitz, were published in part under the editorship of Golius, and Laet, and have been frequently used by naturalists of the present century. An atlas of colored drawings from the hand of Prince Maurice is still preserved in the Royal Library in Berlin. Here are depicted 34 species of mammals, 100 of birds, 55 of reptiles, 69 of fishes, and 77 of insects, besides many of plants.

Marcgrave's "Historia Rerum Naturalium Brasiliæ" was printed in Amsterdam in 1648, four years after his untimely death while exploring the coast of Guinea.

Piso's "Medicina Braziliensis," 1648, and his Natural History and Medicine of both Indies, 1658, were also results of Prince Maurice's expedition.

Among other contributions made by the Netherlands to the natural history of America were the "Relation du Voyage de Isle Tobago," Paris, 1606, and the "Histoire Naturelle et Morale des Isles Antilles," Rotterdam, 1658,* written by N. Rochefort, a Protestant missionary to the West Indies, and Jan Nieuhof's "See und Landreize benessens een bondege Beschreyving von gantsch Nederland Brazil so van Landschappen Steden, Deren Gewaffen," &c., printed in 1682.

Jan Jacob Hartsinck, a Dutch traveller in Guiana, printed a book of scientific travels at Amsterdam in 1770.

Philippe Fermin, a Dutch naturalist, resident for many years

* First edition without name of author; others, Paris, 1665; Lyons, 1667; Amsterdam, 1716.

in Surinam, published in Amsterdam two important works upon the natural history of that region, in 1765 his "Histoire Naturelle de la Hollande Equinoxiale," and in 1769 his "Description de Surinam." I refer to these works as important, not because they are of great value to zoölogical writers of to-day, but because they, in their day, marked distinct advances in knowledge.

The Scandinavians.—Danish enterprise at an early day sent explorers to the western continent, and the scholarly tendencies of the Scandinavian mind were soon manifest in a literature of geographical and scientific observations.

Hans Egede, a missionary who went to Greenland at least as early as 1715, published in 1741 his comprehensive work upon Greenland, of which so many editions have been published.

Otho Fabricius, [b. 1744, d. 1822], another missionary, long resident in Greenland, published in 1780 his "Fauna Grœnlandica," a work which in scientific accuracy has never been excelled—a most important contribution to systematic zoölogy. David Crantz's "History of Greenland," published in 1770, is another important scientific work from the hand of a missionary, and Zorgdrager's notices of the Greenland fisheries deserve a passing notice.

The travels of Kalm, a Swede and a pupil of Linnæus, are noticed elsewhere. Peter Loefling, another pupil of Linnæus, visited Spanish America, and in his "Iter Hispanicum," printed in Stockholm, 1758, described many animals and plants observed by him.

Olaf Swartz, a Swede, discovered and described 850 new species of West Indian plants from 1785–89. He spent a year in the southern United States before going to the West Indies.*

The Germans.—Germany, too, soon began to send its students across the Atlantic. Johann Anderson, a Burgomaster of Hamburg, published in 1746 his "Tidings from Iceland, Greenland,

* Brendel.

and Davis Straits, for the benefit of Science and Commerce." Hans Just Winkelmann published in Oldenburg in 1664 "Der Amerikanischen neuen Welt Bescreibung." &c., with descriptions and figures of animals and plants.

Christian Bullen, in 1667, made a voyage to Greenland and Spitzbergen, an account of which, including interesting observations on whales and the whale fishery, was printed at Bremen in 1668.

Marcgrave, Krieg, the two Forsters, and Schoepf are referred to elsewhere. Steller, Pallas and Chamisso are mentioned in connection with Russian explorations.

Madame Maria Sibilla Merian, [b. 1647, d. 1717], who was a native of Frankfort, was an enthusiastic entomologist who travelled in Surinam from 1699–1701. Her paintings of tropical insects were reproduced in a magnificent folio volume, printed 1705–9, which was one of the wonders of her day, and which, together with her other writings upon insects, have secured her a prominent place in the early history of science.

VI.

The seventeenth century was not, upon the whole, a period favorable to the promotion of science, for all Europe was agitated by war and political strife, and men had neither opportunity nor inclination for intellectual pursuits. During its latter half, however, and with the return of peace and tranquillity, science grew in favor as it had never done before. The restoration of the Stuarts to the English throne was quickly followed by the establishment of the Royal Society. Louis XIV. made the period of his accession memorable by founding the Royal Academy of Sciences, and by building an observatory.

This was the period of intellectual activity which followed the revival of letters in Europe. Carus, in his History of Zoölogy, calls it the period of encyclopædia-making, (*Periode der encyklopädische Darstellungen*), filling the interspace between

"The Zoölogy of the Middle Ages" and "the period of Systematic Classification." Students of science had ceased to compile endless commentaries on the works of Aristotle and had begun to record their own observations and thoughts, to gather new facts and materials, which were to serve as a basis for the systematic work for their successors.

The greatest names of the day among naturalists were those of Ray, Tournefort, Lister, Jonston, Goedart, Redi, Willughby, Swammerdam, Sloane, Jung, and Morrison; names not often referred to at the present day, but worthy of our recollection and veneration, for they were men of a new era—the pioneers in systematic zoölogy and botany.

Among the earliest representatives of the new school in North America were Banister, Clayton, Mitchell, and Garden. John Banister, a clergyman of the Church of England, emigrated to Virginia before 1668, and in addition to his clerical duties applied himself assiduously to the study of natural history. He was a disciple and also, no doubt, a pupil of the great English naturalist, John Ray, who called him, in his Historia Plantarum, "erudissimus vir et consummatissimus Botanicus," and corresponded also with Lister, and Compton, Bishop of London. He was the first to observe intelligently the mollusks and insects of North America. In a paper communicated to the Royal Society in 1693 he refers to drawings of ten or twelve kinds of land snails and six of fresh-water mussels. The drawings were not published, nor were the notes, except those in reference to the circulation of a species of snail.*

He sent to Petiver, in 1680, a collection of 52 species of insects, his observations upon which, with notes by Petiver, were a few years later communicated to the Royal Society.†

* Phil. Trans., xvii, 1693, pp. 671–672. See also Trans. Linnæan Soc., vii, p. 227.

† *Some Observations concerning Insects made by Mr. John Banister in Virginia, A. D. 1680, with Remarks on them by Mr. James Petiver*, &c. Phil. Trans., xxii, 1701, pp. 807–814.

Among them many familiar forms are recognizable—the mud-wasp, seventeen-year locust, cimex, cock-roach, firefly, the spring beetle (*Elater*), and the tobacco-moth. He appears to have drawn and described several phases of the life history of the ichneumon-fly. He had in his possession in 1686, and exhibited to an English traveller, large bones and teeth of fossil mammals from the interior of Virginia, the first of which we have any record in North America.*

It was as a botanist, however, that he was best known. He made drawings of the rarer species, and transmitted these with his notes and dried specimens to Compton and Ray. Banister's "Catalogus Plantarum in Virginia observatarum," printed in 1686,† was the first systematic paper upon natural history which emanated from America. In one of his botanical excursions, about the year 1692, he visited the falls of the Roanoke, and, slipping among the rocks, was killed.‡

Lawson, the historian of North Carolina, writing at the beginning of the next century, remarked: "Had not the ingenious Mr. Banister (the greatest virtuoso we ever had on this continent) been unfortunately taken out of this world, he would have given the best account of the plants of America of any that ever yet made such an attempt in these parts."§ The memory of John Banister is still cherished in Virginia, where his descendants are numerous.‖

John Clayton was also an excellent representative of the new school, and should not be confounded with the Rev. John Clayton who visited America in 1685. John Clayton, the naturalist, as

* Perhaps the *Megalonyx Jeffersonii*, subsequently discovered.

† In RAY'S *Historia Plantarum*.

‡ His papers and collections were sent to the Bishop of London. The plants are said to have passed into the hands of Sloane, and to be still preserved in the British Museum. It would be interesting to know what has become of his manuscripts.

§ LAWSON: *History of North Carolina*, Raleigh Ed., p. 134.

‖ See *The Bland Papers* and SLAUGHTER'S *History of Bristol Parish*, 1st and 2d editions.

he is styled in Virginian history, appears to have been born in Fulham, a suburb of London, in 1686, and to have accompanied his father, John Clayton, subsequently Attorney-General of Virginia, when he came to this country in 1705. He was clerk of Gloucester County, Virginia, for fifty-one years, and died December 15, 1773. "He passed a long life," says Thacher, "in exploring and describing the plants of this country, and is supposed to have enlarged the botanical catalogue as much as any man who ever lived." He was a correspondent of Linnæus, Gronovius, and Collinson, and the latter wrote of him in 1764 as "my friend John Clayton, the greatest botanist of America."

Clayton's "Flora Virginica," which was edited by Gronovius, assisted by the young Linnæus, who was just entering upon his career of success, and was then resident in Leyden, began to appear in 1739, subsequent portions being published in 1743 and 1762. It seems to be the opinion of botanists that Gronovius deserves less credit for his share in this work than has usually been allowed him, and that Clayton's descriptions were those of a thorough master of botanical science as then understood. He communicated to the Royal Society various botanical papers, including one upon the culture of the different kinds of tobacco. At his death he left two volumes of manuscripts, and an herbarium, with marginal notes and references for the engraver who should prepare the plates for his proposed work. These were in the possession of his son when the revolutionary war commenced, and were placed in the office of the clerk of New Kent county for security from the invading enemy. The building was burned down by incendiaries, and thus perished not only the records of the county but probably one of the most important works on American botany written before the days of Gray and Torrey.

Jefferson declares that Clayton was a native Virginian, and such is the confusion in the records that it is quite possible that such may be the fact.*

*See *Spotswood Letters*, i. pp. 1, 8; ii, pp. 44, 58, 355.

Still another pioneer was Dr. John Mitchell, born in England about 1680 and settled, early in the last century, at Urbanna, Virginia, where he remained nearly fifty years practising medicine and promoting science. He appears to have been a man of genius and broad culture, and was one of the earliest chemists and physicists in America. His political and botanical writings were well received, and his map of North America is still an authority in boundary matters. He was a correspondent of Linnæus, and in 1740 sent Collinson a paper in which thirty new genera of Virginia plants were proposed.* His Dissertation upon the Elements of Botany and Zoology† was dated Virginia, 1738, and was thus almost contemporary with the first edition of the *Systema Naturæ* of Linnæus, though it was not printed until ten years after it was written. This was the first work upon the principles of science ever written in America. In 1743 he communicated to the Royal Society an "Essay on the Causes of the Different Colours of People in Different Climates,"‡ writing from the standpoint of an evolutionist. He also communicated an "Essay on the Properties and Uses of the Different Kinds of Potash,"§ and a "Letter concerning the Force of Electrical Cohesion."‖ His fame rests chiefly, however, upon his investigations into the yellow fever epidemic of 1737–42, published after his death.¶ In 1743 he appears to have been engaged in physiological researches upon the opossum, which, however, were never published. In 1746 Dr. Mitchell returned to England, and upon the voyage was captured by French or Spanish pirates, and his collections, and apparently his manuscripts, destroyed. He became a Fellow of the Royal Society,

*Darlington, p. 21.

†*Dissertatio brevis de Principiis Botanicorum et Zoologorum, deque novo stabiliendo naturæ rerum Systemati congruo, cum Appendice aliquot generum plantarum recens conditorum et in Virginia observatum.* Nuremburg, 1748.

‡Phil. Trans., xliii, 1744.

§Phil. Trans., xlv.

‖Phil. Trans., l.

¶Amer. Med. & Phil. Reg., iv.

and in 1748 was writing a work upon the natural and medical history of North America.* He died at an advanced age, about 1772. His name is perpetuated in that of our beautiful little partridgeberry, *Mitchella repens*. "Mitchell and Clayton together," says Tuckerman, "gave to the botany of Virginia a distinguished lustre."

Dr. John Tennent, of Port Royal, Va., seems to have been a man of botanical tastes. He it was who brought into view the virtues of the Seneca snake root, publishing at Williamsburgh, in 1736, an essay on pleurisy, in which he treats of the Seneca as an efficient remedy in the cure of this disease.† He also wrote other botanical treatises.‡ Dr. Greham, of Dumfries, Va., was a man of similar tastes, and it is said by Mr. Jefferson that we are indebted to him for the introduction into America of the tomato.

David Krieg, F. R. S., a German botanist, collected insects for Petiver in Maryland, and gathered also hundreds of species of plants. He seems to have returned to England very early in the century, for his name appears in the Philosophical Transactions in 1701.

Col. William Byrd, of "Westover," Va., [b. 1674, d. 1744], was a man of European education, the owner of a magnificent library, in which Stith wrote his history of Virginia, founder of the city of Richmond, colonial agent in London, and President of the King's council. He was a Fellow of the Royal Society, to which he communicated a paper "concerning a negro boy dappled with white spots,"§ and was a correspondent of Collinson, Bartram, and other naturalists. His "History of the Dividing Line" and his "Journey to the Land of Eden," in 1733, contain many inter-

* Smith: *Correspondence of Linnæus*, ii, pp. 442–451.

† Thacher: *Medical Biography*, i, p. 73.

‡ Mitchell writing to Linnæus, in 1748, remarks: "I can now only send you * * * some dissertations of Mr. Tennant upon the *Polygala*, two of which only have come out among his latest publications. His former ones, of inferior merit, are not now to be had."

§ Phil. Trans., 1697.

esting observations upon Indians and general natural history. He it was who, in 1694, carried to England a female opossum, which furnished the materials for the first dissertation upon the anatomy of the marsupiates.*

One of the most eminent of our colonial naturalists was Dr. Alexander Garden, born in Scotland about 1728 [d. 1791]. He emigrated to America about 1750, and practised medicine in Charleston, S. C., until after the close of the revolutionary war, when he returned to England and became very prominent in scientific and literary circles, and vice-president of the Royal Society in 1783. He was an excellent botanist, but did his best work upon fishes and reptiles. He sent large collections of fishes to Linnæus, which were so well prepared that when I examined the fishes in the Linnæan collection in London, in 1883, I found nearly every specimen referred to by him in his letters in excellent condition, though few collected by others were identifiable. Garden was the discoverer of *Amphiuma means*, and was instrumental in first sending the electrical eel to Europe. His letters to Linnæus and to Ellis are voluminous and abound in valuable information. In 1764 he published a description of *Spigelia marilandica*, with an account of its medicinal properties.

James Logan, [b. 1664, d. 1751], a native of Ireland and member of the Society of Friends, accompanied William Penn to this country in 1682 in the capacity of secretary, and became a public man of prominence, serving for two years as governor of the colony of Pennsylvania. He was a man of broad culture and was the author of a translation of Cicero's "De Senectute," printed by Benjamin Franklin in 1744. To Logan belongs the honor of having carried on the first American investigations in physiological botany, the results of which were published in Leyden, in 1739, in an essay entitled "Experimenta et Meletemata de Plantarum Generationis." This essay, which related to

*Edward Tyson: *Carigueya seu Marsupialis, or the Anatomy of an Opossum*, &c., &c. < Phil. Trans., xx, 1698, p. 105.

the fructification of the Indian corn, was accepted in its day as a valuable contribution to knowledge.

Cadwallader Colden [b. 1688, d. 1776] was also a statesman and a naturalist. A native of Scotland, he came to America in 1708, and, after a short residence in Pennsylvania, settled in New York, where he held the office of surveyor-general and member of the King's council, and in later life was for many years lieutenant-governor, and frequently acting-governor of the province. His intellectual activity manifested itself in various directions, and his "History of the Five Indian Nations of Canada," New York, 1727, was one of the earliest ethnological works printed in America. He also was interested in meteorology and astronomy, and as a correspondent of Linnæus and Collinson did much to advance the study of American Botany. His daughter, Miss Jane Colden, was the first lady in America to become proficient in the study of plants. She was the author of a Flora of New York which was never published.* Governor Colden's "Plantae Coldenhamiae," the first part of a catalogue of the plants growing in the neighborhood of his country residence, "Coldenham," near Newburgh, was the first treatise on the flora of New York. It was published in 1744 in the Acts of the Royal Society of Upsala.† A most interesting collection from the scientific correspondence of Colden was published many years ago by Dr. Asa Gray.‡

Hans Sloane, a young Irish physician, [b. 1660, d. 1753], who had been a pupil of Tournefort and Magnol, visited the West Indies in 1684, and after his return printed a Catalogue of Jamaica Plants in 1696, and, later, a sumptuously illustrated work on the natural history of Jamaica (1707–25). After his return he became an eminent physician, and in 1727 succeeded Isaac Newton as President of the Royal Society. The collection of animals and plants made by Sir Hans Sloane in America was greatly increased by him during his long and active life, and, having been be-

* Brendel in Amer. Nat., Dec., 1879. † Torrey: *Flora of New York.*
‡ Amer. Journ. Science, xiv.

queathed by him to the nation, became, upon his death in 1753, the nucleus of the British Museum.

Another naturalist of the same general character was Mark Catesby, [b. 1679, d. 1749], who lived in Virginia, 1712 to 1721, collecting and making paintings of birds and plants; in the Carolinas, 1722 to 1725, and a year also in the Bahamas. His magnificent, illustrated work upon the Natural History of Carolina, Florida, and the Bahamas,* is still of great value to students of natural history.

The name of John Bartram, the Quaker naturalist of Philadelphia, is possibly better remembered than those of his contemporaries. This is no doubt due to the fact that he left behind him a lasting monument in his botanic garden on the banks of the Schuylkill. He was the earliest native American to prosecute studies in systematic botany, unless Jefferson's statement concerning Clayton proves to be true. Linnæus is said to have called him "the greatest natural botanist in the world," and George III. honored him in 1765 with the title of "Botanist to his Majesty for the Floridas," and a pension of fifty pounds a year. Bartram was a most picturesque and interesting personage, and a true lover of nature. He did great service to botany by supplying plants and seeds to Linnæus, Dillenius, Collinson, and other European botanists. He was a collector, however, rather than an investigator, and his successes seem to have been due, in the main, to the patient promptings and advice of his friend Collinson in London. Garden, whom he visited at Charleston, in 1765, after his appointment as King's Botanist, wrote of him to Ellis:

"I have been several times into the country with him and have told him the classes, genera, and species of all the plants that occurred which I knew. I did this in order to facilitate his enquiries, as I find that he knows nothing of the generic characters of plants and can neither class nor describe them, but I see that,

* London, 1754–71.

from great natural strength of mind and long practice, he has much acquaintance with the specific characters; though his knowledge is rude, inaccurate, indistinct, and confused, seldom determining well between species and varieties. He is, however, alert, active, industrious, and indefatigable in his pursuits."*

Fothergill says in his Memoir of Collinson "that the eminent naturalist, John Bartram, may almost be said to have been created by my friend's assistance."

The foregoing remarks concerning the elder Bartram are simply for the purpose of calling attention to his proper position among the American naturalists of his day. It is not that I esteem Bartram the less, but that I esteem Garden, Clayton, Mitchell and Colden more. The name of Bartram brings up at once that of his friend and patron, Peter Collinson, just as that of Garden reminds us of John Ellis.

Collinson and Ellis were never in America, yet if any men deserve to be called the fathers of American natural history it is they. For a period of thirty years or more, that period during which Linnæus was bringing about those reforms which have associated his name forever with the history of the classificatory sciences, these enlightened and science-loving London merchants seem to have held the welfare of American science in their keeping and to have faithfully performed their trust. I know few books which are more delightful than Darlington's "Memoir of Bartram" and Smith's "Correspondence of Linnæus," made up as they are largely of the letters which passed between Collinson and Ellis and their correspondents in America, and with Linnæus, to whom they were constantly transmitting American notes and specimens.†

Humphrey Marshall [b. 1722, d. 1801] was a farmer-botanist of the Bartram type, and the author of "The American Grove," a treatise upon the forest trees and shrubs of the United States,

* Smith: *Correspondence of Linnæus*, i, p. 537.

† Darlington: *Memoirs of Bartram and Marshall.*

the first botanical work which was entirely American. Darlington's "Memorials of Bartram and Marshall" is a worthy tribute to this useful man.

Moses Bartram, a nephew of John, was also a botanist, and William, his son. [b. 1739, d. 1823], was a much more prominent figure in American science. His "Travels through North and South Carolina," published in 1791, was, in the opinion of Coues, the starting-point of a distinctively American school of ornithology.

Collinson was a correspondent of Benjamin Franklin, and is said not only to have procured and sent to him the first electrical machine which came to America, but to have made known to him in 1743 the results of the first experiments in electricity, the continuation of which gave to Franklin his European reputation as a man of science. Collinson was instrumental in introducing grape culture in Virginia, and in acclimating here many foreign ornamental shrubs.

Ellis was a more eminent man of science, and his name is associated with the beginnings of modern marine zoölogy. Linnæus wrote to him in 1769: "Your discoveries may be said to vie with those of Columbus. He found out America, or a new India, in the West; you have laid open hitherto unknown Indies in the depths of the ocean." He was royal agent for West Florida, and had extraordinary facilities for obtaining specimens from the colonies.

His nephew, Henry Ellis, F. R. S., [b. 1720, d. 1805], was the author of "A Voyage to Hudson's Bay in 1746 and 1747 for discovering a Northwest Passage," which contains some valuable notes upon zoölogy. He was in 1756 appointed governor of the colony of Georgia, and in 1758 published in the Philosophical Transactions an essay on "The Heat of the Weather in Georgia." In 1760 he made a voyage for the discovery of a new passage to the Pacific, and later was governor of Nova Scotia, where we can but believe he continued his ob-

servations and his correspondence with the savans of Europe. "Finally," says Jones, "having attained a venerable age, and to the last intent upon the prosecution of some favorite physical researches, he fell in sleep, as did Pliny the Elder, within sight of Vesuvius, and upon the shores of the beautiful Bay of Naples."*

Jones, in his "History of Georgia," [I, p. 444], refers to the Rev. Stephen Hales—"equally renowned as a naturalist and a divine"—who lived for a time in Georgia during the last century. Can this have been the famous author of "Vegetable Statics?" I have been unable to find any allusion to a sojourn in America, in the published notices of the English Hales, and equally unable to discover a second Hales in the annals of science.

The central figure among eighteenth-century naturalists was of course Linnæus. His Systema Naturæ was an epoch-making work, and with the publication of its first edition at Leyden in 1735 the study of the biological sciences received an impress which was soon felt in America.

In 1738, while in Leyden, he assisted Gronovius in editing the notes sent by Clayton from Virginia, and it is evident that Linnæus was already, at the age of thirty, recognized by European botanists as an authority upon the plants of America. It was in this year that he visited Paris. He at once made his way to the Garden of Plants, and entered the lecture-room of Bernard de Jussieu, who was describing some exotics to his pupils in Latin. There was one which the demonstrator had not yet determined, and which seemed to puzzle him. The Swede looked on in silence at first, but observing the hesitation of the learned Professor, cried out: "Haec plantam faciem Americanam habet." Jussieu turned about quickly with the exclamation, "You are Linnæus."

It is interesting to notice how strongly the Linnæan reforms took root in American soil, and how soon. Collinson wrote to

* *History of Georgia.*

Bartram in 1737: "The Systema Naturæ is a curious performance for a young man, but his coining a new set of names for plants tends but to embarrass and perplex the study of Botany. As to his system, * * * botanists are not agreed about it. Very few like it. Be that as it will, he is certainly a very ingenious man, and a great naturalist."* Six years later he wrote to Linnæus himself:

"Your system I can tell you obtains much in America. Mr. Clayton and Dr. Colden at Albany are complete professors, as is Dr. Mitchell at Urbana, in Virginia."†

This may not seem a very numerous following, but twelve years after this (1755), only seven English botanists were mentioned by Collinson in response to a request from Linnæus to know what botanical people in London were skilled in his plan.‡

It is a fact not often referred to that during his period of poverty and struggles, Linnæus received, through the influence of his patron, Boerhaave, an appointment in the colony of Surinam. His prospects for a successful career in Europe had, however, brightened, and he decided not to come to America.

His interest in American natural history was always very great, and his descriptions of New World forms seem to have been drawn up with especial care. Garden, Colden, Bartram, Mitchell, Clayton and Ellis were all, as we have seen, active in supplying him with materials, and his pupils, Kalm, Alstroem, Loefling, Kuhn and Rolander (who collected for many years in Surinam) sent him many notes and specimens.

The progress of systematic zoölogy in the interval between Ray and Linnæus may perhaps best be illustrated by some brief statistical references. The former, in 1690, made an estimate of the number of animals and plants known at that time.

The number of beasts, including serpents, he placed at 150, ad-

* DARLINGTON, p. 106. † SMITH, i, p. 9.

‡ SMITH, i, p. 33.

ding that according to his belief not many that are of any considerable bigness in the known regions of the world have escaped the cognizance of the curious.

Linnæus in his 12th edition (1766) described 210 species of beasts or mammals, and 124 of reptiles so called. Of the mammals known to Linnæus, 78, or more than one-third, were American, and 88 of the reptiles were attributed to this continent.

"The number of birds," said Ray, "may be near 500." Linnæus catalogued 790, of which about one-third were American.

Although at this time the Middle and Southern States were the most active in the prosecution of scientific researches, there were in New England at least two diligent students of nature. Paul Dudley, F. R. S., [b. 1675], chief-justice of the colony of Massachusetts, was the author of several papers in the Philosophical Transactions. Among these were "A Description of the Moose Deer in America,"* "An Account of a Method Lately Found Out in New England for Discovering Where the Bees Hive in the Woods,"** "An Account of the Rattlesnake,"† and "An Essay Upon the Natural History of Whales, with a Particular Account of the Ambergris Found in the Spermaceti Whale,"‡ which is often quoted.

Others were an "Account of the Poison Wood Tree in New England,"§ and "Observations on Some Plants of New England, with Remarkable Instances of the Nature and Power of Vegetation."‖ He also appears to have sent to Collinson a treatise upon the evergreens of New England.¶

The Rev. Jared Eliot, [b. 1685, d. 1763], minister at Killingworth, in Connecticut, and one of the earliest graduates of Yale College, described by his contemporaries as "the first physician of his day," and as "the first botanist in New England," appears

* Phil. Trans., xxxi, 1721.
** Phil. Trans., xxxi, 1721, p. 148–50.
† Phil. Trans., xxxii, p. 292–5.
‡ Phil. Trans., xxxiii, 1725, pp. 256–69.
§ Phil. Trans., xxi, p. 135.
‖ Phil. Trans., xxxiii, p. 129.
¶ See Tuckerman in *Archæologia Americana*, iv, pp. 125–6.

to have been a correspondent of Franklin, and a scientific agriculturist.

In 1781 appeared Jefferson's "Notes on Virginia." This was the first comprehensive treatise upon the topography, natural history, and natural resources of one of the United States, and was the precursor of the great library of scientific reports which have since been issued by the state and federal governments.

The book, although hastily prepared to meet a special need, and not put forth as a formal essay upon a scientific topic, was, if measured by its influence, the most important scientific work as yet published in America. The personal history and the public career of Thomas Jefferson are so familiar to all that it would be an idle task to repeat them here. Had he not been a master in statecraft, he would have been a master of science. It is probable that no two men have done so much for science in America as Jefferson and Agassiz—not so much by their direct contributions to knowledge as by the immense weight which they gave to scientific interests by their advocacy.

Many pages of Jefferson's "Notes on Virginia" are devoted to the discussion of Buffon's statements: (1) that the animals common to both continents are smaller in the New World; (2) that those which are peculiar to the New are on a smaller scale; (3) that those which have been domesticated in both have degenerated in America, and (4) that, on the whole, America exhibits fewer species. He successfully overthrows the specious and superficial arguments of the eloquent French naturalist, who, it must be remembered, was at this time considered the highest authority living in such matters. Not content with this, when Minister Plenipotentiary to Europe a few years later, he forced Buffon himself to admit his error.

The circumstance shall be related in the words of Daniel Webster, who was very fond of relating the anecdote:

"It was a dispute in relation to the moose, and in one of the circles of the *beaux-esprits* in Paris, Mr. Jefferson contended for

some characteristics in the formation of the animal which Buffon stoutly denied. Whereupon Mr. Jefferson wrote from Paris to General John Sullivan, then residing in Durham, New Hampshire, to procure and send him the whole frame of a moose. The General was no little astonished at a request he deemed so extraordinary, but well acquainted with Mr. Jefferson, he knew he must have sufficient reason for it; so he made a hunting party of his neighbors and took the field. They captured a moose of unusual proportions, stripped it to the bone, and sent the skeleton to Mr. Jefferson at a cost of fifty pounds sterling. On its arrival, Mr. Jefferson invited Buffon and some other *savants* to a supper at his house and exhibited his dear bought specimen. Buffon immediately acknowledged his error. 'I should have consulted you, Monsieur,' he said, 'before publishing my book on Natural History, and then I should have been sure of my facts.'"

In still another matter in which he was at variance with Buffon he was manifestly in the right. In a letter to President Madison, of William and Mary College, he wrote:

"Speaking one day with M. de Buffon on the present ardor of chemical inquiry, he affected to consider chemistry but as cookery, and to place the toils of the laboratory on a footing with those of the kitchen. *I* think it, on the contrary, among the most useful of sciences and *big* with future discoveries for the utility and safety of the human race."

It was the scientific foresight of Jefferson, so manifest in such letters, which led him to advocate so vigorously the idea that science must be the corner-stone of our Republic.

In 1789 he wrote from Paris to Dr. Willard, president of Harvard College:

To Dr. Willard:

What a field have we at our doors to signalize ourselves in. The botany of America is far from being exhausted, its mineralogy is untouched, and its Natural History or zoölogy totally mistaken and misrepresented. * * * It is for such institutions as that over which you preside so worthily, sir, to do justice to our country, its productions, and its genius. It is the work to which the young men you are forming should lay their hands. We have spent the prime of our lives in procuring them the precious blessing of liberty. Let them spend theirs in showing that it is the great parent of *science* and of virtue, and that a nation will be great in both always in proportion as it is free.

THOMAS JEFFERSON.

To Jefferson's interest was due the organization of the first government exploring expedition. As early as 1780 we find him anxious to promote an expedition to the upper portion of the Mississippi Valley, and offering to raise 1000 guineas for the purpose from private sources, and while he was President he dispatched Lewis and Clarke upon their famous expedition into the northwest—the precursor of all the similar enterprises carried on by the general Government, which have culminated in our magnificent Geological Survey.

Jefferson's personal influence in favor of science was of incalculable value. Transferred from the presidency of the principal American scientific society to the presidency of the nation, he carried with him to the Executive Mansion the tastes and habits of a scientific investigator. Mr. Luther, in his recent essay upon "Jefferson as a Naturalist,"* has shown that during his residence in Paris he kept the four principal colleges—Harvard, Yale, William and Mary, and the College of Philadelphia—informed of all that happened in the scientific circles in Europe.

He wrote to one correspondent: "Nature intended me for the tranquil pursuits of science by rendering them my supreme delight." To another he said: "Your first gives me information in the line of natural history, and the second promises political news. The first is my passion, the last my duty, and therefore both desirable."

When Jefferson went to Philadelphia to be inaugurated Vice-President he carried with him a collection of fossil bones which he had obtained in Green Brier county, Virginia, together with a paper, in which were formulated the results of his studies upon them. This was published in the Transactions of the American Philosophical Society, and the species is still known as *Megalonyx Jeffersoni*.

"The spectacle," remarks Luther, "of an American states-

* Magazine of American History, April, 1885.

man coming to take part as a central figure in the greatest political ceremony of our country, and bringing with him an original contribution to science, is certainly one we shall not soon see repeated." *

When Jefferson became President, his scientific tastes were the subject of much ridicule as well as of bitter opposition among the people in whose eyes, even in that day, science was considered synonymous with atheism. William Cullen Bryant, then a lad of thirteen, wrote a satirical poem, "The Embargo," since suppressed, in which the popular feeling seems to have been voiced:

> "Go, wretch, resign the Presidential chair;
> Disclose thy secret measures, foul or fair.
> Go search with curious eyes for horned frogs
> Mid the wild wastes of Louisianian bogs,
> Or, where the Ohio rolls his turbid stream,
> Dig for huge bones, thy glory and thy theme."

A prominent personage in the history of this period was Peter Kalm, a pupil of Linnæus and Professor in the University of Aobo, who was sent to America by the Swedish government, and travelled through Canada, New York, New Jersey, and Pennsylvania from 1748–51. Although the ostensible object of his mission was to find a species of mulberry suitable for acclimatization in Sweden, with a view to the introduction of silk-culture, it is very evident that he and his master were very willing to make of applied science a beast of burden, upon whose back they could heap up a heavy burthen of investigations in pure science. Kalm's botanical collections were of great importance and are still preserved in the Linnæan herbarium in London. His "Travels into North America" are full of interesting observations upon animals and men, as well as upon plants, and give us an insight into the life of the naturalists at that time resident in America. After his return to Sweden he published several papers relating to his discoveries in America.

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* *op. cit.*

Another traveller who deserves our attention, Johann David Schœpf, [b. 1752, d., in Baireuth, 1800], the author of one of the earliest monographs of the Testudinata, was a surgeon of mercenary troops under the Margrave of Anspach, and was one of the hated "Hessian" auxiliaries during the revolutionary war (1776-83). While stationed at New York he wrote a paper upon the Fishes of New York, which was published in Berlin in 1787. This was the first special ichthyological paper ever written in America or concerning American species. Immediately after the treaty of peace in 1783, Schœpf made an extensive tour through the United States, proceeding from New York south to Florida and the Bahamas. He was accompanied in his more southern excursions by Prof. Marter and Dr. Stupicz, who with several assistants had been sent to America from Vienna to make botanical explorations. Schœpf's "Nord Amerikanische Reisen" is full of interesting notes upon natural history, and describes nearly all the scientific men at that time resident in the United States. His "Materia Medica Americana," published in 1787 at Erlangen, was a standard in its day.*

One of the most prominent names in American natural history is that of Johann Reinhold Forster, [b. 1729, d. 1798], who was a leader in zoölogical studies in England during the last century. He was a native of Germany, and at the time of his death Professor of Botany at Halle. He spent many years in England, and was the naturalist of Cooke's second voyage around the world (1772–75). In 1771 he published in London, in an appendix to his translation of Kalm's Travels, "A Catalogue of the Animals of North America, compiled from the writings of Linnæus, Pennant, Brisson, Edwards and Catesby, and in the same year a similar nominal catalogue of the plants of North America. His account of the birds sent from Hudson's Bay, published in 1772, was a valuable contribution to American ornithology,

* Erlangen, 1788, 2 vols., 8°.

"notable," says Coues, "as the first formal treatise exclusively devoted to a collection of North American birds sent abroad." Fifty-eight species were described, among which were several new to science. Other papers of equal value were published upon the quadrupeds and fishes of the same region. Forster was one of the earliest students of the geographical distribution of animals, and his "Enchiridion of Natural History" was in its day a standard. His son, John George Forster, who was his companion in the voyage of circumnavigation, owes his fame to his literary rather than to his scientific labors. He published a paper on the Patella or Trumpet Fish found at Bermuda.*

The annals of Russian explorations upon the west coast of North America have been so exhaustively recorded by Dall in his "Alaska and its Resources," that only passing mention need be made of the two German naturalists, Steller and Chamisso, whose names are identified with the natural history work of the Russian explorer.

Among the other naturalists whose names are associated with America during this period may be mentioned Sonnini de Manoncourt, an eminent French zoölogist, who travelled in Surinam from 1771 to 1775 and made important contributions to its ornithology. Don Felix de Azara, [b. 1746, d. after 1806], who carried on researches in Spanish America from 1781 to 1801; Don Antonio Parra, who published a useful treatise on the natural history of Cuba in Havana, in 1787; Don Jose C. Mutis, a learned Spanish ecclesiastic and physician, professor of natural history in the University of Santa Fe de Bogota, in Grenada, who carried on a voluminous correspondence with Linnæus and his son from 1763 to 1778,† and Joseph Jussieu, botanist to the King of France, who went to the west coast of South America in 1734 as a member of the commission sent by the Royal Academy of Sciences to make observations to determine more accurately the shape and magni-

*Phil. Trans., 1, p. 859.

† SMITH: *Correspondence of Linnæus*, ii, pp. 507–550.

tude of the earth. "His curiosity," says Flourens, "held him captive for many years in these regions, so rich and unexplored, where he often joined the labors of the engineer with those of the botanist. To him Europe owes several new plants, the heliotrope, the marvel of Peru, &c., with many curious and then unknown species." Here, also, should be mentioned the eminent French ornithologist, Francois Levaillant, [b. 1753, d. 1824], who was a native of America, and the two Mexican naturalists, also native born, Jose A. Alzate, [b. in Ozumba, 1729, d. in Mexico, Feb. 2, 1790], a learned botanist, and Francisco Javier Clavigero.

Francisco Javier Clavigero, the historian of Mexico, was one of the earliest of American archæologists. Born in Vera Cruz Sept. 9, 1731, the son of a Spanish scholar, he was educated at the college of Puebla, entered the Society of Jesuits, and was sent out as a missionary among the Indians, with whom he spent thirty-six years. He learned their language, collected their traditions, and examined all their historical records and monuments for the purpose of correcting the misrepresentations of early Spanish writers. When the Society of Jesus was suppressed by Spain, in 1767, Clavigero went to Italy, where he wrote his "Storia Antica del Messico," printed in 1780–81.

Clavigero was a man who, in his spirit, was fully abreast of the science of his day, but whose methods of thought and argument were already antiquated.

His monastic training led him to write from the standpoint of a commentator rather than that of an original observer, and his observations upon the animals and plants of Mexico were subordinated in a very unfortunate manner to those of his predecessor, Hernandez. In the "Dissertations," which make up the fourth volume of his history, he throws aside, in the ardor of his dispute with Buffon and his followers, the trammels of tradition, and places upon record many facts concerning American natural history which had never before been referred to. He here presented a list of the quadrupeds of America, the first ever printed for the en-

tire continent, including 143 species; not systematically arranged, it is true, but perhaps as scientific in its construction as was possible at that time, even had its author been trained in the school of Linnæus.

Clavigero's dissertations are well worthy of the attention of naturalists even of the present day. His essay upon the manner in which the continent of America was peopled with living forms, shows a remarkable appreciation of the difficulties in the way of the solution of this still unsolved problem. The position taken by its author is not unlike that held by zoögeographers of to-day, in considering it necessary to bridge with land the waters between Asia and Northwestern America, and Africa and South America.* In his first "Dissertation of the Animals of Mexico" he combats the prevailing European views as to the inferiority of the soil and climate of the New World and the degeneracy of its inhabitants, engaging in the same battle in which fought also Harriott, Acosta, and Jefferson.

Clavigero's contributions to archæology and ethnology are extensive and valuable, and we can but admit that at the time of the issue of his "Storia Antica" no work concerning America had been printed in English which was equally valuable.

Although in his formal discussion of the natural history of Mexico he follows closely the nomenclature and arrangement of Hernandez, there are many important original observations inserted. I will instance only the notes on the mechanism of the poison-gland and fang of the rattlesnake, the biographies of the possum, the coyote and the tapir, and the Tuza or pouched rat, the mocking-bird, the chegoe and the cochineal insect. Clavigero states that Father Inamma, a Jesuit missionary of California, has made many experiments upon snakes which serve to confirm those made by Mead upon vipers.

To the post-revolutionary period belongs Dr. Manasseh Cutler,

*See similar speculation in George Scot's *Model of the Government of the Province of East New Jersey in America*. Edinburgh, 1685.

for fifty-one years minister of Ipswich Hamlet, Mass., [b. 1743, d. 1823], who in 1785 published "An Account of some of the Vegetable Productions naturally growing in this part of America, botanically arranged,"* in which he described about 370 species. Cutler was a correspondent of Muhlenberg in Pennsylvania, Swartz and Payshull in Sweden, and Withering and Stokes in England. He left unpublished manuscripts of great value. He was one of the founders of the settlement in Ohio, and at one time a member of Congress. After Cutler, says Tuckerman, there appeared in the Northeastern States nothing of importance until the new school of New England Botanists, a school characterized by the names of an Oakes, a Boott, and an Emerson, was founded in 1814, by the publication of Bigelow's "Florula Bostoniensis."

Thomas Walter [b. in Hampshire, 1740] published in London, in 1787, his "Flora Caroliniana," a scholarly work describing the plants of a region situate upon the Santee river.†

Dr. Hugh Williamson, of North Carolina, [b. 1735, d. 1819], was a prominent member of the American Philosophical Society. He was concerned in some of the earliest astronomical and mathematical work in America; published papers upon comets and climatology, which were favorably received, and secured his election to many foreign societies, and in 1775 printed in the Philosophical Transactions his "Experiments and Observations on the Gymnotus Electricus or Electric Eel."

Dr. Caspar Wistar [b. 1761, d. 1818] was one of the early professors of chemistry [1789] and anatomy [1793] in the College of Philadelphia. He was the discoverer of some important points in the structure of the ethmoid bone, a man of eminence as a teacher, and versed in all the sciences of his day.

Dr. James Woodhouse, of Philadelphia, [b. 1770, d. 1809], made investigations in chemistry, mineralogy, and vegetable physiology which were considered of importance.

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*Mem. Amer. Acad. Sci., 1785.

† See Brendel, American Naturalist, Dec., 1879, p. 759.

The story of the origin of American scientific societies has been so often told that it need not be repeated here. The only institutions of the kind which were in existence at the end of the period under consideration were the American Philosophical Society, an outgrowth primarily of the American Society for the Advancement of Natural Knowledge, founded in Philadelphia in 1743, and secondarily of Franklin's famous "Junto," whose origin dates back to 1727, and the American Academy of Arts and Sciences, founded in 1780.

The relations of the colonial naturalists to the scientific societies of England have not so often been referred to, and it does not seem to be generally known that the early history of the Royal Society of London was intimately connected with the foundation of New England, and that the first proposition for the establishment of a scientific society in America was under consideration early in the seventeenth century. "The great Mr. Boyle," writes Eliot, "Bishop Wilkins, and several other learned men, had proposed to leave England and establish a society for promoting natural knowledge in the new colony, of which Mr. Winthrop, their intimate friend and associate, was appointed governor. Such men were too valuable to lose from Great Britain; and Charles II. having taken them under his protection, the society was there established, and obtained the title of the Royal Society of London."*

For more than a hundred years the Royal Society was the chief resource of naturalists in North America. The three Winthrops, Mitchell, Clayton, Garden, Franklin, Byrd, Rittenhouse, and others were among its fellows, and the Philosophical Transactions contained many American papers.

As at an early date the Society of Arts in London began to offer prizes for various industrial successes in the colonies, for instance, for the production of potash and pearlash, for the culture of silk, and for the culture of hemp, the vine, safflower, olives,

*Eliot: *Biographical Dictionary.*

logwood, opium, scammony, burilla, aloes, sarsaparilla, cinnamon, myrtle wax, the production of saltpetre, cobalt, cochineal, the manufacture of wine, raisins, and olive oil, the collection of gum from the persimmon tree, and the acclimation of silk grass. A medal was given in 1761 to Dr. Jared Eliot, of Connecticut, for the extraction of iron from "black sand."* In 1757 we find their secretary endeavoring to establish branch societies in the colonial cities, especially in Charleston, Philadelphia and New York, and Garden seems to have tried to carry out the enterprise in Charleston. After two years he wrote that the society organized had become "a mere society of drawing, painting, and sculpture."

In a subsequent letter he utters a pitiful plaint. He has often wondered, he says, "that there should be a country abounding with almost every sort of plant, and almost every species of the animal kind, and yet that it should not have pleased God to raise up one botanist."†

The American Academy of Arts and Sciences was founded by the Legislature of Massachusetts in 1780 and its first volume of memoirs appeared in 1785.

In 1788 an effort was made by the Chevalier Quesnay de Beaurepaire to found in Richmond, Virginia, the "Academy of Arts and Sciences of the United States of America" upon the model of the French Academy. The plan was submitted to the Royal Academy of Sciences in Paris, and received its unqualified endorsement, signed, among others, by Lavoisier. A large subscription was made by the Virginians and a large building erected, but an academy of sciences needs members as well as a president, and the enterprise was soon abandoned.‡

In 1799 was organized the Connecticut Academy of Arts and Sciences, which, after publishing one volume of Transactions,

* See Dossie: *Memoirs of Agriculture*. London, vol. i, 1768, pp. 24–6, *et seq.*, also Brock in Richmond Standard, April 26, 1879, p. 4.

† Smith: *op. cit.*, i, p. 477.

‡ See Mordecai: *Richmond in By-gone Days*. A copy of the original pamphlet of proposals is still preserved in the Virginia State Library.

went into a state of inactivity from which it did not arouse itself until 1866.

This sketch would not be complete without some reference also to the history of scientific instruction in America during the last century.

The first regular lectures upon a special natural history topic appear to have been upon comparative anatomy. A course upon this topic was delivered at Newport, Rhode Island, in 1754, by Dr. William Hunter, a native of Scotland, [b. about 1729], a kinsman of the famous English anatomists, William and John Hunter, and a pupil of Munro. His course upon comparative anatomy was given in connection with others upon human anatomy and the history of anatomy, the first medical lectures in America.*

The first instruction in botany was given in Philadelphia in 1768 by Kuhn, who began in May of that year a course of lectures upon that subject in connection with his professorship of Materia Medica and Botany in the College of Philadelphia. Adam Kuhn [b. in Germantown, Pa., 1741, d. 1817] was educated in Europe, and had been a favorite pupil of Linnæus. He did not, however, continue his devotion to natural history, though he became an eminent physician. William Bartram, son of John Bartram, was elected to the same professorship in 1782. In 1788 Prof. Waterhouse, of Harvard College, read lectures upon Natural History to his medical classes, and is said to have subsequently claimed that these were the first public lectures upon natural history given in the United States. This was doubtless an error, for we find that in 1785 a course upon the philosophy of Chemistry and Natural History was delivered in Philadelphia. "People of every description, men and women, flock to these lectures," writes a contemporary. "They are held at the University three evenings in a week."†

*One of the original tickets to these courses is in the Library of the Surgeon-General's office in Washington.

† DARLINGTON, p. 535.

The first professor of chemistry was Dr. Benjamin Rush, who lectured in the Philadelphia Medical School as early as 1769. Bishop Madison was professor of chemistry and natural philosophy at William and Mary College, from 1774 to 1777; Aaron Dexter, of chemistry and materia medica at Harvard, 1783 to 1816; John Maclean, at Princeton, 1795–1812, being the first to occupy a separate chair of chemistry. Before the days of chemical professorships, the professor of mathematics seems to have been the chief exponent of science in our institutions of learning.

John Winthrop, [b. 1714, d. 1779], for instance, who was Hollis Professor of Mathematics and Natural Philosophy at Harvard from 1738 to 1779, was a prominent Fellow of the Royal Society, to whose Transactions he communicated many important papers, chiefly astronomical. We read, however, that Count Rumford imbibed from his lectures his love for physical and chemical research, and from this it may be inferred that he taught as much of chemistry as was known in his day. William Small, professor of mathematics in William and Mary from 1758 to 1762, was a man of similar tastes, though less eminent. He was the intimate friend of Erasmus Darwin. President Jefferson was his pupil, attended his lectures on natural philosophy, and got from time to time his "first views of the expansion of science and of the system of things in which we are placed."

Dr. Samuel Latham Mitchill [b. 1764, d. 1831] was the first man to hold a professorship of natural history, lecturing upon that subject, together with chemistry, in Columbia College in 1792. Dr. Mitchill was eminent as a zoölogist, mineralogist, and chemist, and not only published many valuable papers but in 1798 established the first American scientific journal.

Harvard appears to have had the first separate professorship of natural history, which was filled by William Dandridge Peck, a zoölogist and botanist of prominence in his day.

A professorship of botany was established in Columbia College, N. Y., as early as 1795, at which time Dr. David Hosack [b. in

New York, 1769, d. 1835] was the incumbent. Dr. Hosack brought with him from Europe in 1790 the first cabinet of minerals ever seen in the United States. In its arrangement he was assisted by one of his pupils, Archibald Bruce, who became, in 1806, Professor of Mineralogy, and who, soon after, in 1810, established the American Journal of Mineralogy.

Dr. Hosack was the founder of the first public botanic garden—this was in New York in 1801; another was founded in Charleston in 1804. These had disappeared forty years ago, and the one at Cambridge, established in 1808, is the only one now in existence.

The first public museum was that founded in Philadelphia, in 1785, by Charles Wilson Peale; the bones of a mammoth and a stuffed paddle-fish forming its nucleus. This establishment had a useful career of nearly fifty years.

VII.

We have now rehearsed the story of the earliest investigators of American natural history, including two centuries of English endeavor, and nearly three if we take into consideration the earlier explorations of the naturalists of continental Europe.

We have seen how, in the course of many generations, the intellectual supremacy of the Western Continent went from the Spaniards and the French and the Dutch to the new people who were to be called Americans, and we have become acquainted with the men who were most thoroughly identified with the scientific endeavors of each successive period of activity.

The achievements of American science during the century which has elapsed since the time when Franklin, Jefferson, Rittenhouse, and Rumford were its chief exponents have been often the subject of presidential addresses like this, and the record is a proud one. During the last fifty years in England, and the last forty in America, discovery has followed discovery with such rapid succession that it is somewhat hard to realize that

American science in the colonial period, or even that of Europe at the same time, had any features which are worthy of consideration.

The naturalists whose names I have mentioned were the intellectual ancestors of the naturalists of to-day. Upon the foundations which they laid the superstructure of modern natural history is supported. Without the encyclopædists and explorers there could have been no Ray, no Klein, no Linnæus. Without the systematists of the latter part of the eighteenth century the school of comparative anatomists would never have arisen. Had Cuvier and his disciples never lived there would have been no place for the philosophic biologists of to-day.

The spirit of the early naturalists may be tested by passages in their writings which show how well aware they were of the imperfections of their work. Listen to what John Lawson, the Carolina naturalist, wrote in the year 1700:

"The reptiles or smaller insects are too numerous to relate here, this country affording innumerable quantities thereof; as the flying stags with horns, beetles, butterflies, grasshoppers, locust, and several hundreds of uncouth shapes, which in the summer season are discovered here in Carolina, the description of which requires a large volume, which is not my intent at present, besides, what the mountainous part of this land may hereafter open to our view, time and industry will discover, for we that have settled but a small share of this large province cannot imagine, but there will be a great number of discoveries made by those that shall come hereafter into the back part of this land, and make enquiries therein, when, at least, we consider that the westward of Carolina is quite different in soil, air, weather, growth of vegetables, and several animals, too, which we at present are wholly strangers to, and seek for. As to a right knowledge thereof, I say, when another age is come, the ingenious then in being may stand upon the shoulders of those that went before them, adding their own experiments to what was delivered down to them by their predecessors, and then there will be something towards a complete natural history, which, in these days, would be no easy undertaking to any author that writes truly and compendiously as he ought to do."

Herbert Spencer, in his essay on "The Genesis of Science,"

lays stress upon the fact that the most advanced sciences have attained to their present power by a slow process of improvement, extending through thousands of years, that science and the positive knowledge of the uncultured cannot be separated in nature, and that the one is but a perfected and extended form of the other. "Is not science a growth?" says he. "Has not science its embryology? And must not the neglect of its embryology lead to a misunderstanding of the principles of its evolution and its existing organization?"

It seems to me unfortunate, therefore, that we should allow the value of the labors of our predecessors to be depreciated, or to refer to the naturalists of the last century as belonging to the unscientific or to the archaic period. It has been frequently said by naturalists that there was no science in America until after the beginning of the present century. This is, in one sense, true, in another, very false. There were then, it is certain, many men equal in capacity, in culture, in enthusiasm, to the naturalists of to-day, who were giving careful attention to the study of precisely the same phenomena of nature. The misfortune of men of science in the year of 1785 was that they had three generations fewer of scientific predecessors than have we. Can it be doubted that the scientists of some period long distant will look back upon the work of our own time as archaic and crude, and catalogue our books among the "curiosities of scientific literature?"

Is it not incumbent upon workers in science to keep green the memory of those whose traditions they have inherited? That it is, I do most steadfastly believe, and with this purpose I have taken advantage of the tercentenary of American biology to read this review of the work of the men of old.

Monuments are not often erected to men of science. More enduring, however, than monuments are those living and self-perpetuating memorials, the plants and animals which bear the names of the masters who knew them and loved them. Well have the Agassizs remarked that "there is a world of meaning hid-

den under our zoölogical and botanical nomenclature known only to those who are intimately acquainted with the annals of scientific life in its social as well as its professional aspect."*

I hope I am not at this day entirely alone in my appreciation of the extreme appropriateness of this time-honored custom, although I know that many of our too matter-of-fact naturalists are disposed to abandon it, and that it is losing much of its former significance. In fact, in these days of unstable nomenclature, such tributes are often very evanescent. It seems fortunate that the names of some of the most honored of the early naturalists are perpetuated in well established generic and specific combinations.†

When I see the *Linnæa borealis*, I am always reminded of the sage of Upsala, as he is represented in the famous Amsterdam painting, clad in Lapland fur, and holding a spray of that graceful arctic plant. *Magnolia* and *Wistaria* call up the venerable professors of botany at Montpelier and Philadelphia. *Tradescantia virginica* reminds me of John Tradescant and the Ashmolean Museum, whose beginnings were gathered by him in Virginia. The cape jessamine (*Gardenia*), the spring beauty (*Claytonia*), the partridge berry (*Mitchella*), the iron weed (*Vernonia*), the *Quercus Bartramii* (=*Q. heterophylla*), the *Scarus Catesbyi*, *Tha-*

* *Seaside Studies in Natural History*, p. 25.

† The genus HARRIOTTA has been dedicated by Goode and Bean to the memory of *Thomas Harriott*. It is intended to embrace a long-rostrated chimæroid fish from deep water off the Atlantic coast of North America. The description is not yet published. "Heriot's Isle," named for Harriott by the early explorers, and shown upon Vaughan's map, in Smith's "Generall History of Virginia," has entirely disappeared. It was situate on the north side of Albemarle Sound, about midway between Roanoke Island and the mouth of Chowan river. Whether it has been swept away by the tides, or has become a part of the main-land, it is difficult to say. The latter supposition seems the most probable, and since it is in all likelihood "Reed's Point" which now occupies its former location. the propriety is suggested of calling this little cape, "Harriott's Point," in memory of the explorer.

lictrum and *Asclepias Cornuti*, *Macrurus Fabricii*, *Didelphys* and *Canis Azaræ*, *Chauliodus Sloanei*, *Alutera Schœpfii*, *Sterna*, *Forsteri*, *Stolephorus Mitchilli*, *Malacanthus Plumieri*, *Salix Cutleri* and *Pinus Banksiana*, the *Kalmia*, the *Jeffersonia*, the *Hernandia*, the *Comptonia*, the *Sarracenia*, the *Gaultheria*, the *Kuhnia*, the *Ellisia*, the *Coldenia*, the *Robinia*, the *Banisteria*, the *Plumieria*, the *Collinsonia*, the *Bartramia*, all bear the names of men associated with the beginnings of Natural History in America.

Yet, pleasant as it is to recall in such manner the achievements of the fathers of natural history, let us not do them the injustice to suppose that posthumous fame was the object for which they worked. Like Sir Thomas Browne, they believed that "the world was made to be inhabited by beasts, but to be studied by man." Let us emulate their works and let us share with them the admonitions of the "Religio Medici."

"The wisdom of God," says Browne, "receives small honor from those vulgar heads that rudely stray about, and with a gross rusticity admire his works; those highly magnify him whose judicious inquiry into his acts, and deliberate research into his creatures, return the duty of a devout and learned admiration. Therefore," he continues—

> "Search while thou wilt and let thy reason go
> To ransom truth, even to the abysse below,
> Rally the scattered causes, and that line
> Which nature twists be able to untwine.
> It is thy Maker's will, for unto none
> But unto reason can He e'er be known."

ADDITIONS TO THE FLORA OF WASHINGTON AND VICINITY, FROM APRIL 1, 1884, TO APRIL 1. 1886.

By F. H. Knowlton, B. S.

[The following notes are supplementary to Ward's "Guide to the Flora of Washington and Vicinity" (Bulletin No. 22, U. S. National Museum). The species added to the Flora between April 1, 1884, and April 1, 1885, were enumerated by Prof. Ward in a paper read before the Society Dec. 13, 1884; the additions and changes for 1885 were presented by the author in a paper read March 20, 1886. The first collector of each species is given due credit in the proper place.]

ANALYSIS.

I. List of Vascular Plants added to the Flora from April 1, 1884, to April 1, 1886. . . . . p. 106
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I. LIST OF VASCULAR PLANTS ADDED TO THE FLORA OF WASHINGTON FROM APRIL 1, 1884, TO APRIL 1, 1886.

11*a*. **Trautvetteria palmata**, Fischer & Meyer.

Great Falls, Virginia side. Mr. J. S. Barker, June 22, 1884. Also found on the Mt. Vernon estate by Mr. William Hunter, June 21, 1885.

22*a*. **Caltha palustris**, L. Marsh Marigold.

Rock Creek. Collected by Mr. Gerald McCarthy in 1884.

99*a*. **Polygala Curtissii**, Gray, var. **pycnostachya**, Gray.

Collected south of Arlington P. O., near Four Mile Run, June 29 and July 30, 1884, and on the Marlboro' road, August 3, 1884, by Prof. Ward. Specimens of this plant have been sent to Dr. Asa Gray, who states that he considers this form to be the type, and that the original specimens col-

lected by Curtiss were abnormal. Until an authoritative revision of the genus is made, however, it must stand as above.

195*a*. **Trifolium hybridum**, Savi.
Alexander's Island, June 25, 1885, by Mr. J. A. Allen.

295*a*. **Ribes floridum**, L'Her. WILD BLACK CURRANT.
Blagden's Mill, at the head of the mill-race on the creek side, April 27, 1884. Prof. Ward.

297*a*. **Sedum Telephium**, L.
Found near Woodlawn (Mt. Vernon) July 25, 1885, by Mr. Wm. Hunter.

351*a*. **Aralia quinquefolia**, Decsne & Planch.
Collected by the late Dr. A. C. Schott in the vicinity of Rockville, Md., nearly twenty-five years ago. The specimens have, unfortunately, all been sent to Scotland and none since collected.

390*a*. **Eupatorium purpureum**, L., var. **amœnum**, Gray.
Rock Creek, Sept. 17, 1882. Mentioned as a form in the "Flora" by Prof. Ward.

391*a*. **Eupatorium hyssopifolium**, L., var. **laciniatum**, Gray.
Back of Mount Hamilton, Oct. 11, 1885. Prof. Ward and the author.

436*a*. **Aster ericoides**, L., var. **villosus**, Torr & Gray.
Near upper end of Lobelia Run, Sept. 17, 1882. Prof. Ward.

462*a*. **Inula Helenium**, L. ELECAMPANE.
Found on the Mount Vernon estate, one mile west of the Mansion, by Mr. William Hunter, who states that it has been established there for thirty years.

494*a*. **Bidens connata**, Muhl. SWAMP BEGGAR-TICKS.
Holmead Swamp, September 22, 1878. Placed in the herbarium under the name of *Bidens cernua*, L., and only recently detected. Prof. Ward.

502*c*. **Artemisia vulgaris**, L. MUGWORT.
Collected at the mouth of Pope's Head Creek, near Clifton Station, Fairfax county, Va., October 9, 1884, by Prof. Ward.

563*a*. **Clethra alnifolia**, L. White Alder. Sweet Pepper Bush.

Left bank of Bladensburg mill-race below second foot bridge, 200 yards above sluice gate. In flower July 27, 1884, in fruit August 24, 1884. Prof. Ward.

585*a*. **Apocynum androsæmifolium**, L.

Collected near Woodlawn, Fairfax county, Va., August, 1885, by Mr. Wm. Hunter.

614*a*. **Hydrophyllum Canadense**, L. Waterleaf.

In a ravine containing a cataract which was christened "Hydrophyllum Run," nearly opposite Eads' Mill, Va., July 6, 1884, then a little past flowering time. Prof. Ward. Fine flowering specimens collected June 21, 1885.

620*a*. **Borago officinalis**, L.

Foundry Run, June 23, 1885. Mr. A. L. Schott.

675*a*. **Gerardia auriculata**, Michx.

Below Alexandria, Va., Sept. 9, 1885. Mr. Wm. Hunter.

825*a*. **Comptonia asplenifolia**, Ait. Sweet Fern.

Between the Reform School and Highlands, Md., on an abandoned earthwork, June 22, 1884, by Prof. Ward.

826*a*. **Betula lenta**, L. Cherry, Sweet, or Black Birch.

Found by Dr. G. W. Hill at the mouth of Difficult Run, Va., May 11, 1884. Dr. Hill states that he could find no full-grown trees, and none bearing fruit or flowers. Mr. Wm. Hunter reports this species from Clifton Station, Va., also as a mere shrub.

The following remarkable forms of *Quercus*, supposed to be of hybrid origin, are deserving of special mention in the catalogue. Most of them were described by Dr. George Vasey in an article published in the "Bulletin of the Torrey Botanical Club" for March, 1883, with figures (plates xxviii–xxx). Their principal peculiarities were further pointed out in a paper by Prof. Ward, read before this Society April 13, 1883.

The names given below are based on the assumption that they are hybrids, the one standing first being that of the species supposed to predominate in the hybridism.

831*a*. **Quercus alba × obtusiloba.**

Discovered by Dr. Vasey near Silver Spring, Maryland, September 20, 1882.

831*b*. **Quercus alba × Prinus.**

On the Rockville Road a few rods north of Woodley Park Road. Discovered October 22, 1882, by Prof. Ward. A large tree standing just inside the fence on the west side of the road.

832*a*. **Quercus obtusiloba × alba.**

Discovered by Dr. Vasey by the roadside near Piney Branch, September 20, 1882.

836*a*. **Quercus Prinus × alba.** SAUL'S OAK.

Pointed out to Dr. Vasey by Mr. John Saul in his nursery, just back of his residence, September 20, 1882.

890*a*. **Potamogeton crispus**, L.

Near mouth of Gravelly Run, Va., October 26, 1884. The specimens seen were all without fruit. Prof. Ward and the author.

924*a*. **Allium sativum**, L. ENGLISH GARLIC.

Georgetown College grounds, July 22, 1882. Prof. Ward. In addition to this locality he found it below the Insane Asylum, June, 1884.

1093*a*. **Carex utriculata**, Boott.

Eastern Branch Marsh, June 8, 1879. These specimens were confounded with those of *C. riparia* from the same locality, and under that name sent to Mr. Walter Deane, of Cambridge, who pointed out the error.

1101*a*. **Sporobolus vaginæflorus**, Torr.

Monument Grounds, Sept. 12, 1885. Prof. Ward.

1103*a*. **Agrostis canina**, L.

Vacant lots near B. & O. depot, July, 1885. Prof. F. Lampson Scribner.

1125*a*. **Eatonia obtusata**, Gray.

Collected by Dr. George Vasey, June, 1884.

1153*a*. **Bromus tectorum**, L.

Kendall Green, July, 1885. Prof. F. Lampson Scribner.

1172*a*. **Phalaris arundinacea**, L.

Collected on the Seventh street road by Dr. Geo. Vasey, June, 1884.

1205*a*. Taxodium distichum, Richard.

Marshall Hall, Md., Sept. 13, 1885. Collected by Mr. Wm. Palmer and Mr. O. N. Bryan. Mr. Bryan regards these trees as undoubtedly indigenous.

1225*a*. Asplenium montanum, Willd.

A short distance above Great Falls, Virginia side, Aug. 30, 1885. Mr. Wm. Palmer.

1233*a*. Aspidium spinulosum, Swz. SPINULOSE WOOD FERN.

In a ravine (Goldianum Run) on the Virginia side of the Potomac, opposite the Distributing Reservoir, July 6, 1884, by Prof. Ward.

1248*a*. Lycopodium inundatum, L.

Near the Sarracenia swamp; first detected May 10, 1885. Fruiting specimens collected Sept. 10, 1885. Also found near Woodlawn, Fairfax Co., Va., Oct. 1885, by Wm. Hunter.

1248*a*. Lycopodium annotinum, L.

Specimen in herb. Mr. Wm. Palmer, said to have been collected by Dr. E. Foreman in Holmead Swamp. Station long since obliterated.

1249*a*. Lycopodium clavatum, L.

Above Great Falls, Virginia side, Aug. 30, 1885, by Mr. Wm. Palmer. Also Silver Spring, Md., Jan. 2, 1886.

1382*a*. Nitella megacarpa, Allen.

Eastern Branch, above Benning's Bridge, Sept. 21, 1884. In fine fruiting condition. Identified by Dr. T. F. Allen, of New York.

II. A REVISION OF THE MUSCI AND HEPATICÆ OF WASHINGTON AND VICINITY, WITH NUMEROUS ADDITIONS.

By Rev. E. LEHNERT.

[It is with great pleasure that I am able to include in this communication the much-needed revision of our Mosses and Liverworts, which has been so kindly placed at my disposal by Mr. Lehnert. The list given in the "Flora," which was prepared by Mr. Rudolph Oldberg, enumerates 127 species. We are now able to augment that list by the addition of 111 species, of which 83 are Frondosi and 28 Hepaticæ, making a total of 238 species.

The nomenclature followed is, for the Frondosi, "The Mosses of North America," by Lesquereux and James, and for the Hepaticæ, the "Descriptive Catalog of Hepaticæ," by Underwood.]

A. MUSCI FRONDOSI.

ORD. 1. *SPHAGNACEÆ.*

Sphagnum cymbifolium, Ehrh.
" squarrosum, Pers.
" acutifolium, Ehrh.
" subsecundum, Nees.
" intermedium, Hoff.

ORD. 2. *ANDREÆACEÆ.*

Andreæa rupestris, Turn.

ORD. 3. *BRYACEÆ.*

a. Acrocarpi.

1. PHASCEÆ.

Ephemerum crassinervium, Hampe.
" stenophyllum, Schimp.
" cohærens, Muell.
" spinulosum, Br. & Sch.
Sphærangium triquetrum, Schimp.
Phascum cuspidatum, Schreb.
Pleuridium subulatum, Br. & Sch.
" alternifolium, Brid.
" Sullivantii, Aust.
Archidium Ravenelii, Aust.
Bruchia flexuosa, Muell.
" brevifolia, Sull.

2. WEISIEÆ.

Astomum nitidulum, Schimp.
" Sullivantii, Schimp.
Weisia viridula, Brid.
Trematodon longicollis, Michx.
Dicranella varia, Schimp.
" heteromalla, Schimp.
Dicranum scoparium, Hedw.
" majus, Turn.
" Drummondii, Muell.
" undulatum. Turn.

3. FISSIDENTEÆ.

Fissidens adiantoides, Hedw.
" taxifolius, Hedw.
" minutulus, Sull.
" osmundoides, Hedw.

4. LEUCOBRYEÆ.

Leucobryum vulgare, Hampe.
" minus, Sull.

5. CERATODONTEÆ.

Ceratodon purpureus, Brid.

6. POTTIEÆ.

Pottia truncata, Fuern.
Leptotrichum tortile, Muell.
" vaginans, Lesq. & James.
" pallidum, Hampe.
" glaucescens, Hampe.
Barbula unguiculata, Hedw.
" marginata, Br. & Sch.
" cæspitosa, Schwg.
" convoluta, Hedw.
" muralis, Timm.

7. GRIMMIEÆ.

Grimmia apocarpa, Hedw.
" Pennsylvanica, Schwg.
" Olneyi, Sull.
" conferta, Funck.
Racomitrium fasciculare, Brid.
Hedwigia ciliata, Ehrh.

8. ORTHOTRICHEÆ.

Ptychomitrium Drummondii, Sull.
" incurvum, Sull.
Drummondia clavellata, Hook.
Ulota crispa, Brid.
" crispula, Brid.
" Huthinsiæ, Schimp.
Orthotrichum canadense, Br. & Sch.
" obtusifolium, Schrad.
" exiguum, Sull.

Orthotrichum strangulatum, Beauv.
" Ohioense, Sull. & Lesq.
" cupulatum, Hoff.
" psilocarpum, James.

9. TETRAPHIDEÆ.

Tetraphis pellucida, Hedw.

10. PHYSCOMITRIEÆ.

Physcomitrium pyriforme, Brid.
" Hookeri, Hampe.
Funaria hygrometrica, Sibth.
" flavicans, Michx.
" calvescens, Schwg.

11. BARTRAMIEÆ.

Philonotis Muhlenbergii, Brid.
" fontana, Brid.
Bartramia pomiformis, Hedw.
" radicalis, Beauv.

12. BRYEÆ.

Leptobryum pyriforme, Schimp.
Webera albicans, Schimp.
Bryum argenteum, L.
" cæspiticium, L.
" capillare, L.
" pseudotriquetrum, Schwg.
Rhodobryum roseum, Schrb.
Mnium stellare, Reich.
" hornum, L.
" Drummondii, Br. & Sch.
" punctatum, Hedw.
" cuspidatum, Hedw.
" affine, Bland.

13. AULACOMNIEÆ.

Aulacomnium palustre, Schwgr.
" heterostichum, Br. & Sch.

14. POLYTRICHEÆ.

Atrichum angustatum, Beauv.
" undulatum, Beauv.
" crispum, James.

Pogonatum brevicaule, Brid.
" umigerum, Brid.
Polytrichum commune, L.
" juniperinum, Willd.
" perigoniale, Michx.
" formosum, Hedw.
" piliferum, Schreb.

15. BUXBAUMIEÆ.

Diphyscium foliosum, Mohr.
Buxbaumia aphylla, L.

b. Cladocarpi.

16. FONTINALEÆ.

Fontinalis biformis, Sull.
Dichelyma subulatum, Myrin.
" capillaceum, Br. & Sch.

c. Pleurocarpi.

17. NECKEREÆ.

Cryphæa glomerata, Br. & Sch.
Neckera pennata, Hedw.
Leptodon trichomitrion, Mohr.

18. LEUCODONTEÆ.

Leucodon julaceus, Sull.
" brachypus, Sull.
Clasmatodon parvulus, Sull.

19. LESKEÆ.

Thelia hirtella, Sull.
" asprella, Sull.
" Lescurii, Sull.
Leskea obscura, Hedw.
" polycarpa, Ehrh.
" denticulata, Sull.
" tristis, Cesat.
Anomodon rostratus, Schimp.
" attenuatus, Hûb.
" obtusifolius, Br. & Sch.

20. ORTHOTHECIEÆ.

Platygyrium repens, Br. & Sch.
Pylaisia intricata, Br. & Sch.
" velutina, Br. & Sch.

Homalothecium subcapillatum, Sull.
Cylindrothecium cladorrhizans, Schimp.
" seductrix, Sull.
" Drummondii, Br. & Sch.
" compressum, Br. & Sch.
Climacium Americanum, Brid.

21. HYPNEÆ.

Hypnum minutulum, Hedw.
" scitum, Beauv.
" recognitum, Hedw.
" delicatulum, Linn.
" lætum, Brid.
" acuminatum, Beauv.
" salebrosum, Hoff.
" velutinum, L.
" rutabulum, L.
" Novæ-Angliæ, Sull & Lesq.
" rivulare, Bruch.
" populeum, Hedw.
" plumosum, Swartz.
" strigosum, Hoff.
" Boscii, Schwgr.
" Sullivantii, Spruce.
" hians, Hedw.
" piliferum, Schreb.
" demissum, Wils.
" Novæ-Cesareæ, Aust.
" recurvans, Schwgr.
" deplanatum, Schimp.
" serrulatum, Hedw.
" rusciforme, Weis.
" Alleghaniense, Muell.
" micrans, Swartz, var. fulvum.
" denticulatum, L.
" Sullivantiæ, Schimp.
" sylvaticum, Huds.
" minutissimum, Sull. & Lesq.
" serpens, L.

Hypnum radicale, Beauv.
" orthocladon, Beauv.
" riparium, Hedw.
" vacillans, Sull.
" hispidulum, Brid.
" chrysophyllum, Brid.
" stellatum, Schreb.
" uncinatum, Hedw.
" fluitans, L.
" molluscum, Hedw.
" imponens, Hedw.
" cupressiforme, L.
" curvifolium, Hedw.
" arcuatum, Ldb.?
" pratense, Koch.
" stramineum, Dicks.
" Schreberi, Willd.
" splendens, Hedw.
" Oakesii, Sull.
" triquetrum, L.

B. MUSCI HEPATICI.

ORD. 1. *RICCIACEÆ.*

Riccia lutescens, Schwein.
" fluitans, L.
" natans, L.
" arvensis, Aust.

ORD. 2. *ANTHOCEROTACEÆ.*

Anthoceros punctatus, L.
" lævis, L.
Notothylas orbicularis, Sull.

ORD. 3. *MARCHANTIACEÆ.*

Marchantia polymorpha, L.
Conocephalus conicus, Dumort.
Asterella hemisphærica, Beauv.
Dumortiera hirsuta, Nees.
Fimbriaria tenella, Nees.
Lunularia cruciata, Dumort.

ORD. 4. *JUNGERMANIACEÆ.*

Aneura palmata, Nees.
Pellia epiphylla, Nees.
Blasia pusilla, L.
Steetzia Lyellii, Lehm.
Metzgeria pubescens, Raddi.
" conjugata, Lindb.
Frullania Grayana, Mont.
" tamarisci, Nees.
" Virginica, Gottsche.
" brunnea, Spreng.
" Eboracensis, Gottsche.
" plana, Sull.
Phragmicoma cucculata? Nees.
Lejeunia cyclostipa? Tayl.
" calyculata, Tayl.
" minutissima, Dumort.
Madotheca platyphylla, Dumort.
" porella, Nees.
Radula complanata, Dumort.
" tenax, Lindb.
" obconica, Sull.
Blepharostoma trichophylla, Dumort.
Blepharozia ciliaris, Dumort.
Trichocolea tomentella, Dumort.
Bazzania trilobata, B. Gr.
Lepidozia reptans, Dumort.
" setacea, Mitt.
Calypogeia trichomanis, Corda.
" Sullivanti, Aust.
Geocalyx graveolens, Nees.
Chiloscyphus polyanthos, Corda.
Lophocolea bidentata, Dumort.
" heterophylla, Nees.
" minor, Nees.
Odontoschisma sphagni, Dumort.
" denudata, Dumort.
Cephalozia curvifolia, Dumort.
" multiflora, Lindb.

Jungermania Schraderi, Mart.
Scapania albicans, Mitt.: var. taxifolia, Undw.
" nemorosa, Nees.
" compacta, Dumort; var. irigua, Undw.
Plagiocheila asplenioides, Nees & Mont.
" spinulosa, Nees & Mont.

III. A LIST OF THE LICHENS OF WASHINGTON AND VICINITY.

By Rev. E. Lehnert.

[This great desideratum, a list of our Lichens, is at last supplied, through the indefatigable labors of Mr. Lehnert, who has also placed it at my disposal.

In a prefatory note accompanying the list, Mr. Lehnert says: "So far as known, the Lichens of the District comprise 251 species, with 89 varieties, a total of 340 forms. In the main our species are not as showy as those from the North or South, but have, when compared with the same species from these localities, a dwarfed and depauperate aspect, caused, possibly, by the dryness of our climate, as we have very warm summers and cold winters"].

(According to Tuckerman's Genera Lichenum Emend).

A. GYMNOCARPI.

Trib. 1. Parmeliacei.

Fam. 1. USNEEI.

Ramalina rigida, Pers.
" calicaris, Fr.
" " var. fraxinea, Fr.
" " " farinacea, Schær.
" " " fastigiata, Fr.
" " " canaliculata, Fr.
Cetraria Fahlunensis, Schær.
" juniperina, Ach.
" aleurites, Fr.
" " var. placorodia, Tuck.
" Fendleri, Tuck.
" lacunosa, Ach.
" ciliaris, Ach.
" sæpincola, Ach.
" Oakesiana, Tuck.
Evernia furfuracea, Mann.

Usnea barbata, Fr.
" " var. florida, Fr.
" " " hirta, Fr.
" " " rubiginia, Michx.
" " " dasypoga, Fr.
" " " ceratina, Schær.
" angulata, Ach.
" trichodea, Ach.
Alectoria jubata, L.

Fam. 2. PARMELIEI.

Theloschistes chrysophthalmus, Norm.
" " var. flavicans, Wallr.
" parietinus, Norm.
" polycarpus, Ehrh.
" lychneus, Nyl.
" concolor, Dick.
" " var. effuse, Tuck.
Parmelia perforata, Ach.
" " var. hypotropa, Nyl.
" crinita, Ach.
" saxatilis, Fr.
" physodes, Ach.
" Borreri, Turn.
" " var. rudecta, Tuck.
" lævigata, Nyl.
" tiliacea, Floerke.
" " var. sublævigata, Nyl.
" " " sulphurosa, Tuck.
" cetrata, Ach.
" colpodes, Nyl.
" olivacea, Ach.
" caperata, Ach.
" conspersa, Ach.
" ambigua, Ach.
Physcia speciosa, Nyl.
" hypoleuca, Tuck.
" comosa, Nyl.
" granulifera, Tuck.

Physcia aquila, Nyl. var. detonsa, Tuck.
" pulverulenta, Nyl.
" stellaris, L.
" " var. aipolia, Nyl.
" astroidea, Ach.
" crispa, Nyl.
" tribacia, Tuck.
" cæsia, Nyl.
" obscura, Nyl.
" " var. endochrysea, Nyl.
" adglutinata, Nyl.
Pyxine sorediata, Fr.

Fam. 3. PELTIGEREI.

Sticta pulmonaria, Ach.
" amplissima, Mass.
" quercizans, Ach.
Nephroma lævigatum, Ach.
" Helveticum, Ach.
Peltigera scutata, Leightf.
" aphthosa, Hoff.
" polydactyla, Hoff.
" rufescens, Hoff.
" horizontalis, Hoff.
" canina, Hoff.
" " var. spongiosa, Tuck.
" " " sorediata, Sch.
" " " spuria, Ach.

Fam. 4. PANNARIEI.

Endocarpiscum Guepini, Nyl.
Physma luridum, Mont.
Pannaria lanuginosa, Koerb.
" leucosticta, Tuck.
" microphylla, Delis.
" tryptophylla, Mass.
" molybdæa, Tuck.
" nigra, Nyl.
" rubiginosa, Delis.

Fam. 5. COLLEMEI.

Pyrenopsis Schæreri, Nyl.

Omphalaria phyllisca, Tuck.
Collema myriococcum, Arn.
" pycnocarpum. Nyl.
" cyrtaspis, Tuck.
" verruciforme, Nyl.
" leptaleum, Tuck.
" flaccidum, Ach.
" nigrescens, Ach.
ryssoleum, Tuck.
" pulposum, Nyl.
" limosum, Ach.
" pustulatum, Ach.
Leptogium bolacinum, Stizenb.
" minutissimum, Mass.
" lacerum, Fr.
" pulchellum, Nyl.
" Tremelloides, Fr.
" juniperinum, Tuck.
" chloromelum, Nyl.
" myochroum, Tuck.
" " var. saturnium, Sch.
" " " tomentosum, Sch.

Fam. 6. LECANOREI.

Placodium cinnabarrinum, Anz.
" vittelinum, Ach.
" " var. aurellam, Ach.
" cerinum, Naeg. & Hepp.
" " var. sideritis, Tuck.
" " " pyracea, Nyl.
" aurantiacum, Naeg. & Hepp.
" microphyllinum, Tuck.
" camptidium, Tuck.
" ferrugineum, Hepp.
" " var. pollinii, Tuck.
" " " discolor, Willey.
Lecanora rubina, Ach.
" muralis, Schær.
" pallida, Schær.

Lecanora pallida, var. cancriformis, Tuck.
" " " angulosa, Hoff.
" miculata, Ach.
" subfusca, Ach.
" " var. allophana, Ach.
" " " distans, Ach.
" " " coilocarpa, Ach.
" " " argentata, Ach.
" Hageni, Ach.
" atra, Ach.
" varia, Nyl.
" " var. symmicta, Ach.
" " " sæpincola, Fr.
" Cupressi, Tuck.
" pallescens, Schær.
" " var. rosella, Tuck.
" tartarea, Ach.
" cinerea, Sommer.
" " var. lævata, Fr.
" lacustris, Nyl.
" fuscata, Th., Fr.
" privigna, Nyl.
" " var. pruinosa, Auctt.
" " " Clavus, Koerb.
Rinodina oreina, Mass.
" sophodes, Mass.
" " var. atrocinerea, Nyl.
" " " confragosa, Nyl.
" " " exigua, Fr.
" " " tephraspis, Tuck.
" constans, Tuck.
" milliaria, Tuck.
Pertusaria communis, DC.
" multipuncta, Nyl.
" velata, Nyl.
" pustulata, Nyl.
" Wulffenii, DC.
" leioplaca, Schær.

Pertusaria globularis, Ach.
Conotrema urceolatum, Tuck.
Gyalecta Pineti, Fr.
" cupularis, Schær.
" geoica, (?) Ach.
" lutea, Tuck.
Urceolaria scruposa, Snif.
" " var. parasitica, Sommerf.
" " " gypsacea, Nyl.
" actinostoma, Pers.
Myriangium Curtissii, M. & B.

Trib. I. Lecideacei.

Fam. 1. CLADONIEI.

Cladonia Papillaria, Hoff.
" pyxidata, Fr.
" " var. Pocillum, Ach.
" alcicornis, Floerke.
" symphycarpa, Fr.
" " var. epiphylla, Nyl.
" Mitrula, Tuck.
" cariosa, Spreng.
" decorticata, Floerke.
" fimbriata, Fr.
" " var. tubæformis, Fr.
" " " radiata, Fr.
" gracilis, Fr.
" " var. verticillata, Fr.
" " " hybrida, Schær.
" " " cervicornis, Floerke.
" degenerans, Floerke.
" Santensis, Tuck.
" cæspiticia, Fl.
" furcata, Fr.
" " var. subulata, Fl.
" " " racemosa, Fl.
" rangiferina, Hoff.
" " var. sylvatica, L.
" " " alpestris, L.
" uncialis, Fr.

Cladonia macilenta, Hoff.
" Floerkiana, Fr.
" pulchella, Schwein.
" cristatella, Tuck.
" leporina, Fr. (var.)
Cystocoleus rupestris, Rabh.

Fam. 2. LECIDEEI.

Bæomyces roseus, Pers.
Biatora rufo-nigra, Tuck.
" coarctata, Th. Fr.
" decolorans, Fr.
" russula, Mont.
" sanguineo-atra, Fr.
" atro-rufa, Ach
" exigua, Fr.
" milliaria, Fr.
" anomala, Fr.
" mixta, Fr.
" rubella, Fr.
" " var. spadicea, Ach.
" " " suffusa, Fr.
" " " Schweinitzii, Tuck.
" " " incompta, Nyl.
" " " inundata, Fr.
" " " arceutina, Ach.
" umbrina, Ach.
" chlorosticta, Tuck.
" vernalis, Fr.
" uliginosa, Fr.
" hypnophila, Turn.
" campestris, Fr.
" resinæ, Fr.
Heterothecium sanguinarium, Tuck.
" leucoxanthum, Spreng.
" vulpinum, Tuck.
Lecidea contigua, Fr.
" enteroleuca, Fr.
" " var. olivacea, Fr.

Lecidea enteroleuca, var. theioplaca, Tuck.
" " " arenaria, Fl.
" insularis, Nyl.
" albo-cœrulescens, Fr.
Buellia lactea, Mass.
" lepidastra, Tuck.
" atro-alba, Fl.
" parasema, Krb.
" " var. cæsio-pruinosa, Nyl.
" " " triphragmia, Nyl.
" " " microcarpa, Nyl.
" dialyta, Nyl.
" myriocarpa, Dl.
" Schæreri, Dnot.
" Elizæ, Tuck.
" petræa, Tuck.
" " var. Montagnei, Fl.
" " " Oederi, Krb.; and others undefined.

Trib. III. Graphidacei.

Fam. 1. LECANACTIDEA.

Lecanactis chloroconia, Tuck.

Fam. 2. OPEGRAPHEI.

Opegrapha demissa, Tuck.
" varia, Fr.
" " var. notha, Fr.
" " " pulicaris, Fr.
" " " diaphora, Fr.
" " " rimalis, Fr.
" atra, Nyl.
" vulgata, Nyl.
Xylographa opegraphella, Nyl.
Graphis scripta, Ach.
" " var. limitata, Schær.
" " " recta, Schær.
" " " serpentina, Ach.
" " " sophistica, Nyl.
" " " assimilis, Nyl.
" dentritica, Ach.

Graphis dentritica, var. inusta, Ach.
" tricosa, Ach.
" nitidia (?), Nyl.

Fam. 3. ARTHONIEI.

Arthonia pyrrhula, Nyl.
" rubella, Nyl.
" cinereo-pruinosa, Schær.
" cinnabarina, Wallr.
Arthonia lecidella, Nyl.
" lurida, Ach.
" patellulata, Nyl.
" astroidea, Nyl.
" epipasta, Ach.
" macularis, Fr.
" obscura, Ach.
" punctiformis, Ach.
" polymorpha, Ach.
" tædiosa, Nyl.
" spectabilis, Fl.
" anastomosans, Ach.
Mycoporum pycnocarpum, Nyl.

Trib. IV. Caliciacei.

Acolium tigillare, Dnot.
Calicium trichiale, Ach.
" brunneolum, Ach.
" subtile, Fr.
" trachelinum, Ach.
" turbinatum, Pers.
" leucopodum, Nyl.
" albo-nigrum, Nyl.

B. ANGIOCARPI.

Trib. V. Verrucariacei.

Fam. 1. ENDOCARPEI.

Endocarpon miniatum, Schær.
" " var. complicatum, Schær.
" " " aquaticum, Schær.
" arboreum, Schwein.
" rufescens, Ach.
" pusillum. Hedw.

Fam. 2. VERRUCARIEI.

Staurothele difractella, Tuck.
" Drummondii, Tuck.
" umbrina, Tuck.
Trypethelium virens, Tuck.
Sagedia lactea, Kbr.
" oxyspora, Tuck.
" cestrensis, Tuck.
Verrucaria epigæa, Ach.
" margacea, Nyl.
" nigrescens, Pers.
" rupestris, Schrad.
" muralis, Ach.
Pyrenula thelena, Tuck.
" micula, Fl.
" punctiformis, Naeg.
" fallax, Nyl.
" gemmata, Naeg.
" hyalospora, Tuck.
" glabrata, Mass.
" Santensis, Nyl.
" nitida, Ach.
" lactea, Tuck.
" subprostans, Tuck.
" falliciora, Nyl.
" leucoplaca, Kbr.
" thelomorpha, Tuck.

IV. CHANGES IN NOMENCLATURE.

[The recent published works of Drs. Gray and Vasey have made necessary many changes in the nomenclature of our species. It has been suggested that these changes be deferred until the publication of a second edition of the "Flora," but this has seemed to be inadvisable, as it must be some years before a second edition can be brought out, if ever, and if we are constantly confronted by the old names we shall never become familiar with the new and correct ones.]

295. **Ribes rotundifolium**, Michx., = **Ribes oxycanthoides**, Linn.
Pointed out by Mr. Walter Deane, of Cambridge, who has carefully compared it at the Gray Herbarium.

395. **Eupatorium pubescens**, Muhl., = **Eupatorium rotundifolium**, L., var. **ovatum**, Torr.

412. Solidago stricta, Ait., = Solidago neglecta, Torr. & Gr.

414. Solidago Virga-aurea, L., var. humilis, Gray. = Solidago humilis, Pursh.

416. Solidago elliptica, Ait., = Solidago Elliottii, Torr. & Gray.

417. Solidago arguta, Ait., = Solidago juncea, Ait.

418. Solidago altissima, L., = Solidago rugosa, Mill.

439. Aster miser, L., (Ait. of Gray's "Manual"), = Aster vimineus, var. foliolosus, Gray. (?)

440. Aster simplex, Willd., = Aster paniculatus, Lam.

442. Aster carneus, Nees, = Aster salicifolius, (Lam.) Ait.

443. Aster æstivus, Ait.,= Aster junceus, Ait.

445. Aster puniceus, L., var. vimineus, Torr. & Gray, = Aster puniceus, L., var. lucidulus, Gray.

449. Diplopappus linearifolius, Hook., = Aster linearifolius, L.

450. Diplopappus umbellatus, Torr. & Gray. = Aster umbellatus, Mill.

451. Diplopappus cornifolius, Darl., = Aster infirmus, Michx.

473. Eclipta procumbens, Michx., = Eclipta alba, Hasskarl.

489. Verbesina Siegesbeckia, Michx. = Verbesina occidentalis, Walt.

510. Lappa officinalis, Allioni, = Arctium Lappa, L., var. (?)

512. Cnicus discolor, Gray, = Cnicus altissimus, Willd., var. discolor, Gray.

520. Cynthia Dandelion, DC., = Krigia Dandelion, Nutt.

523. Hieracium venosus, L., var. subcaulescens, Gray, = Hieracium venosus, Gray.

526 Taraxacum Dens-leonis, Desf., = Taraxacum officinalis, Weber.

529. Lactuca Canadensis, L., var. integrifolia, Gray, = Lactuca integrifolia, Bigel.

530. Mulgedium acuminatum, DC., = Lactuca acuminata, Gray.

531. Mulgedium Floridanum, DC., = Lactuca Floridana, Gærtn.

532. Mulgedium leucophæum, DC.,= Lactuca leucophæa, Gray.

533. Nabalus albus, Hook., = Prenanthes alba, L.

534. Nabalus Fraseri, DC., = Prenanthes serpentaria, Pursh.

644. Physalis viscosa, L., of Gray's Manual, = Physalis Virginiana, Mill. of Syn., Fl. of N. A. This change has been pointed out by Mr. Deane.

832. **Quercus stellata**, Wang., = **Quercus obtusiloba**, Michx., as adopted by Sargent in his "Forest Trees of N. A.," vol. ix, Tenth Census of United States.

837. **Quercus Muhlenbergii**, Engel, = **Quercus prinoides**, Willd., as adopted by Sargent.

1101. **Vilfa aspera**, Beauv. =**Sporobolus aspera**, Kth.

1105. **Agrostis alba**, L., = **Agrostis vulgaris**, var. **alba**, Vasey.

1114. **Calamagrostis Nuttalliana**, Steud., = **Deyeuxia Nuttalliana**, Vasey.

1124. **Tricuspis seslerioides**, Torr., = **Triodia seslerioides**, Vasey.

1129. **Glycera aquatica**, Smith, = **Glycera arundinacea**, Kth.

1140. **Eragrostis poæoides**, Beav., = **Eragrostis minor**, Host.

1141. **Eragrostis poæoides**, var. **megastachya**, Gray, = **Eragrostis major**, Host.

1165. **Gymnostichum Hystrix**, Schreb., = **Asperella Hystrix**, Willd.

1187. **Panicum pauciflorum**, Ell., = **Panicum scoparium**, Lam.

1198. **Erianthus alopecuroides**, Ell., = **Panicum saccharoides**, Michx.

1199. **Andropogon furcatus**, Muhl., = **Andropogon provincialis**, Lam.

1201. **Andropogon argenteus**, Ell., = **Andropogon argyræus**, Schultz.

1202. **Andropogon Virginicus**, L., = **Andropogon dissitiflorus**, Michx.

1204. **Sorghum nutans**, Gray, = **Chrysopogon nutans**, Benth.

V. NEW LOCALITIES FOR RARE SPECIES.

26. **Aconitum uncinatum**, L.

Near Clifton Station, Va., Sept. 20, 1885, by Prof. Ward.

78. **Thlaspi arvense**, L. Field Pennycress.

Below St. Elizabeth's, May 18, 1884, by Prof. Ward.

106. **Silene nivea**, DC.

Alexander's Island, June 25, 1885. Mr. J. A. Allen.

300. **Drosera rotundifolia**, L.

Sarracenia Swamp, May 10, 1885; also at Fort Ethan Allen, by Mr. William Palmer.

304. **Callitriche Austini**, Engelm.

Brightwood, May 16, 1885. Mr. J. A. Allen.

415. **Solidago rigida**, L.

Woodley Park, in fruit, Oct. 18, 1885. Prof. Ward and myself.

551. **Gaultheria procumbens**, L. **Wintergreen.**

Found on the Mt. Vernon estate, Va., in October, 1884, by Mr. William Hunter.

589. **Asclepias rubra**, L.

Vicinity of Falls Church, Va., Miss M. A. Hayes, July 11, 1885.

599. **Enslenia albida**, Nutt.

Alexander's Island, June 25, 1885. Mr. J. A. Allen. Below Chain Bridge, in fruit, Sept. 12, 1885. Prof. Ward and myself.

627. **Lithospermum canescens**, Lehm.

North side of Woodley Park Road, first bend above the bridge. Collected May 17 and 21, 1884. Prof. Ward.

629*a*. **Heliotropium Europæum**, L. **Heliotrope.**

Alexandria, Va., near the ship-yard, July 4, 1884. Prof. Ward.

672. **Buchnera Americana**, L.

Near Clifton Station, Va., Sept. 20, 1885. Prof. Ward.

732*a*. **Scutellaria parvula**, Mx. **Scullcap.**

Kengla's Woods, June 4, 1884. Prof. Ward.

741. **Plantago cordata**, Lam.

Poplar Point, on the Eastern Branch, October 26, 1884. Prof. Ward and myself. Important on account of its greater accessibility.

805. **Cacalia reniformis**, Muhl.

Alexander's Island, June 25, 1885. Mr. J. A. Allen.

835. **Quercus Michauxii**, Nutt.

Near "Owl Bridge," (Northwest Branch). A large fine tree, quite typical. Found by Mr. H. W. Henshaw and myself, September 11, 1885.

849. **Quercus heterophylla**, Mx.

A fine tree of this species was discovered near Convalescent Camp, Virginia, June 29, 1884, by Prof. Ward. In fine fruiting condition, October 5, 1884. "The affinities of this specimen with **Q. Phellos** are closer than in any of the forms hitherto found. The leaves resemble in almost every respect those which I collected from the tree now standing in the Bartram estate, Philadelphia, south of the mansion, and which is said to have grown from an acorn of the

original Bartram Oak planted by the discoverer." Prof. Ward.

874. **Arisæma Dracontium**, Schott.
Analostan Island, June 20, 1885. Titus Ulke.

918. **Corallorhiza odontorhiza**, Nutt. **Coral-root.**
Found by Mr. Benj. Miller in Kengla's Woods, near the Foundry Run, May 7, 1884, and therefore constituting a case of the vernal blooming of an autumnal species. "I visited this spot in company with Mr. Miller on June 4, 1884, and found the plant nearly extinct. It had died down and withered away without fruiting. On September 28, 1884, I found it in abundance along the Northwest Branch of the Potomac."—Prof. Ward.

919. **Corallorhiza multiflora**, Nutt.
A single specimen, the second ever seen here, was found on the Northwest Branch of the Potomac, Sept. 28, 1884.

946. **Smilacina stellata**, Desf.
High Island, May 11, 1885. Four or five fine specimens found. Hugh M. Smith.

951. **Erythronium albidum**, L.
Found at "Vis-a-vis" Landing, opposite Three Sisters, April 26, 1885. Mr. H. M. Smith.

1211. **Tsuga Canadensis**, Carrière.
Left bank of Pope's Head Creek, one-half mile below Clifton Station, Va., Sept. 20, 1885. Prof. Ward.

1216. **Pellæa atropurpurea**, Link.
Found June, 1885, by Mr. H. M. Smith, on the outer walls of the causeway connecting Analostan Island with the mainland. Plants numerous.

1223. **Asplenium augustifolium**, Michx.
Found at head of Asplenium Run, above Aqueduct Bridge, Sept. 19, 1885. Mr. H. W. Henshaw and myself.

1226. **Camptosorus rhizophyllus**, Link.
Near Burnt Mills, Md., July 1, 1885. Mr. H. W. Henshaw. Also High Island, April, 1885. Mr. J. A. Allen.

1220. **Woodwardia Virginica,** Smith.

Below the Reform School, Aug. 19, 1885. Mr. Wm. Palmer and myself.

VI. SPECIES EXCLUDED.

172 **Vitis vulpina,** L., = **Vitis riparia,** Michx.

The specimens mentioned in the "Flora" that were referred to this species, were collected in flower May 22, 1881, and in young fruit June 4, 1881, at Sandy Landing, Md. Specimens in mature fruit collected Sept. 12, 1885, on the rocks below Chain Bridge. From characters furnished by the seeds and the diaphrams separating the nodes of the stem, as pointed out by Dr. Engelmann, this is referred to the V. riparia, Michx.

220. **Lespedeza violacea,** Pers..= **L. reticulata,** Pers.

This species has been compared at the Gray Herb. by Mr. Walter Deane, and referred as above.

973. **Juncus marginatus,** var. **bifloms,** Engl., = **Juncus marginatus,** Rostk.

Compared at the Gray Herbarium by Mr. Walter Deane who pronounces this to be the type and not the variety.

1251. **Lycopodium complanatum,** L., var. **sabinæfolium,** Spring., = **Lycopodium complanatum,** L.

The forms referred to this variety were collected two miles north of Bladensburg, in young fruit, July 20, 1879, and at Clifton Station, Va., Oct. 12, 1884, by Prof. Ward. These have been submitted to Prof. L. W. Underwood, of Syracuse University, and he pronounces them all to be *complanatum*. This variety, or, as it has been lately known, species, *sabinæfolium*, is distinguished by having the stems leafy to base of spikes, or nearly so, elongated, creeping, usually underground; branches erect, short, dichotomous; leaves 4-rowed, apparently terete.

In *complanatum* the stems are flattened, leaves of two forms, imbricated—oppressed in 4 ranks. These specimens are certainly anomalous in having the stems creeping underground, but otherwise they agree well with the type.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

PUBLISHED WITH THE CO-OPERATION OF THE SMITHSONIAN INSTITUTION.

VOLUME III.

JULY 1, 1884, TO FEBRUARY 6, 1886.

WASHINGTON:
PRINTED FOR THE SOCIETY.
1886.

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